

Hariqbal Singh

101

Chest X-ray

Solutions



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101 CHEST X-RAY SOLUTIONS

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101 CHEST X-RAY SOLUTIONS

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101 Chest X-ray Solutions

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Dedicated to



*My dear father
Harnam Singh
on his 102nd birthday*

*Explosion
Bang on radiology
With CT, PET-CT, MRI, Doppler, SPECT, sonology
Baffling, mystifying, bewildering, perplexing
Comprehend amalgamate understand
Get unbamboozle*

*Corroborate it with patients' state
The diagnosis is made
The treatment is concocted*

*Vigor and strength rejuvenated
All is fine and invigorated
The value of radiology cannot be measured
It can only be treasured.*

Hariqbal

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Preface

Chest X-ray is the most commonly requisitioned film in any medical establishment; consequently, the approach to understanding and exposure to chest X-rays is important.

This book aims to expose the readers to a large number of postero-anterior plain chest films from simple and straightforward to more complicated diagnosis in order to sharpen their skills.

In routine reporting practice often the technical quality is below perfect, such films have also been included in this collection to expose the reader to actual life situation. In most cases complementary studies have been shown which confirm plain film findings and provide additional findings.

This book will benefit all doctors who are exposed to practice medicine in any field. This assemblage of *101 Chest X-ray Solutions* will be useful to all residents entering the domain of any medical specialization and to any general practitioner or specialist in the field of medicine.

Hariqbal Singh

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Anatomy of Chest

Parvez Sheik

Embryologically airway starts developing by fifth week of gestational age in the form of lung buds which grow from ventral aspect of primitive foregut. Trachea and esophagus are also separated by fifth week. Hereafter tracheobronchial tree is formed from fifth to fifteenth week. There are 23–25 airway generations from trachea to bronchiole. Bronchus has cartilage in the wall, whereas bronchiole is devoid of cartilage.

Interstitium of lung is divided into axial interstitium, parenchymal interstitial interstitium and peripheral interstitium. Axial interstitium is made of bronchovascular sheaths and lymphatics. Parenchymal interstitium includes interalveolar septum along alveolar walls. Peripheral interstitium includes sub-pleural connective tissue and interlobular septa which encloses the pulmonary veins and lymphatics.

Pulmonary circulation includes primary pulmonary circulation, bronchial circulation and the anastomoses between the two. Primary pulmonary circulation consists of pulmonary arteries and veins that travel down to sub-segmental bronchial level and has a diameter same as that of the accompanying airway. Main pulmonary artery arises from the right ventricle. Bronchial circulation originates from thoracic aorta and supplies through the intercostals arteries which are two in number for each lung.

Mediastinum is the space between the lungs. It is divided into a superior and an inferior compartment. Superior compartment consists of the thoracic inlet. Inferior compartment has anterior, middle and posterior subcompartments. Retrosternal region is included in the anterior compartment, heart lies in the middle compartment and descending aorta with esophagus and paraspinal region is located in the posterior mediastinal compartment. Thymus is located in the anterior part of superior as well as inferior compartment of mediastinum.

The application of chest CT has greatly increased over the years, however, chest radiography remains the most frequently requisitioned and performed imaging examination. A good understanding of normal anatomy and variations is essential for the interpretation of chest radiographs.

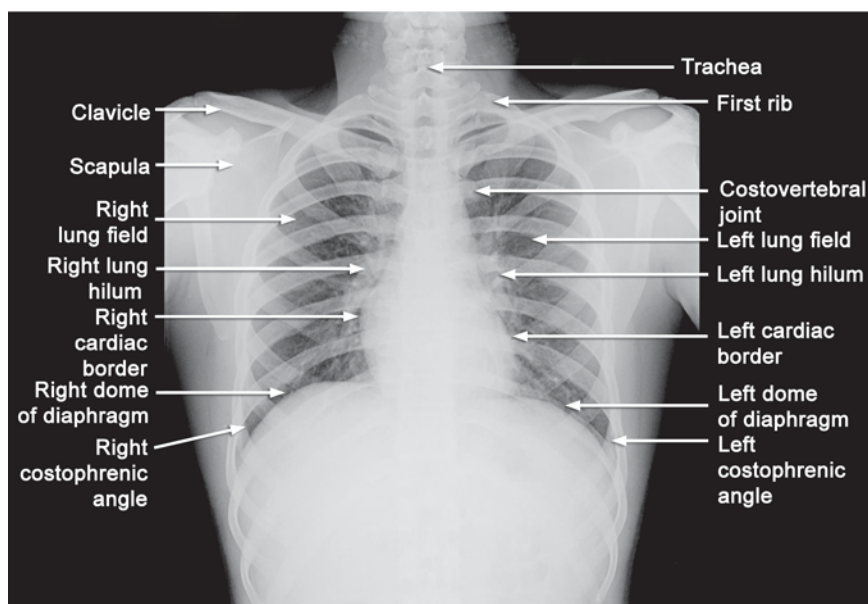


Fig. 1.1: X-ray chest PA view

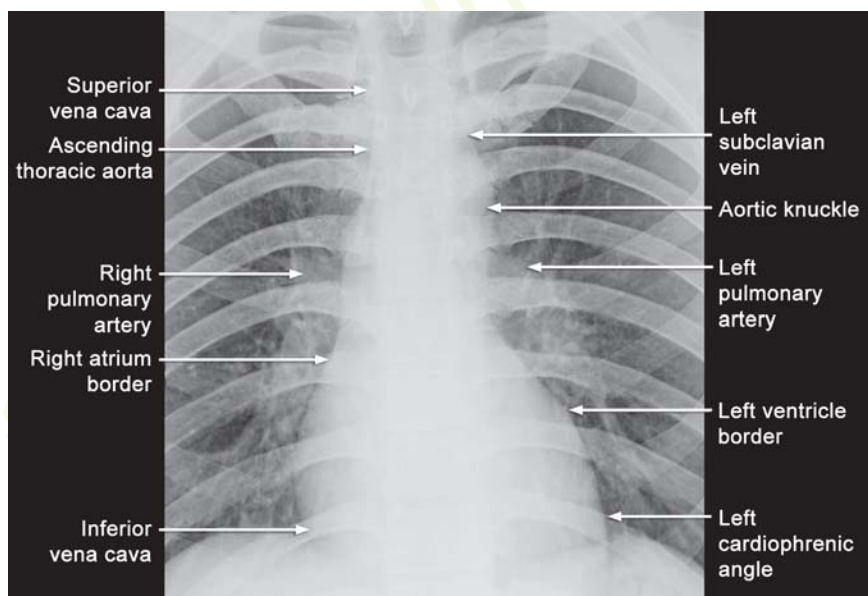


Fig. 1.2: X-ray chest PA view shows mediastinal borders

On posteroanterior (PA) view (Figs 1.1 and 1.2), the X-ray beam first enters the patient from the back and then passes through the patient to the film that is placed anterior to the patient's chest. It uses 80–120 kV

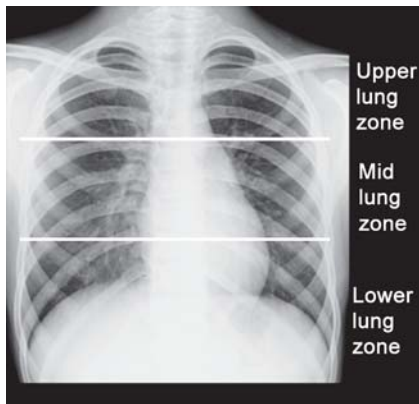


Fig. 1.3: X-ray chest PA view shows the zones

and focus film distance of 6 feet. On a PA film, lung is divided radiologically into three zones (Fig. 1.3):

1. Upper zone extends from apices to lower border of 2nd rib anteriorly.
2. Middle zone extends from the lower border of 2nd rib anteriorly to lower border of 4th rib anteriorly.
3. Lower zone extends from the lower border of 4th rib anteriorly to lung bases.

Radiological division does not depict anatomical lobes of the lung.

Anatomically, segmental division of lungs:

Right lung has three lobes:

1. Upper lobe which has an apical, anterior and a posterior segment.
2. Middle lobe has a lateral and a medial segment.
3. Lower lobe has superior segment, medial basal segment, anterior basal segment, lateral basal segment and a posterior basal segment.

Left lung has two lobes:

1. Upper lobe which has an apico-posterior, anterior, superior lingular and an inferior lingular segment.
2. Lower lobe has superior segment, anterior basal segment, lateral basal segment and a posterior basal segment.

Left lung has no middle lobe.

In a well-centered chest X-ray, medial ends of clavicles are equidistant from vertebral spinous process. Lung fields are of equal transradiance.

Horizontal fissure might be seen on the right side as a thin white line that runs from right hilum to sixth rib laterally. For a fissure to be seen on a radiograph, the X-ray beam has to be tangential to it. The most frequently observed accessory fissure is the azygos lobe fissure which is

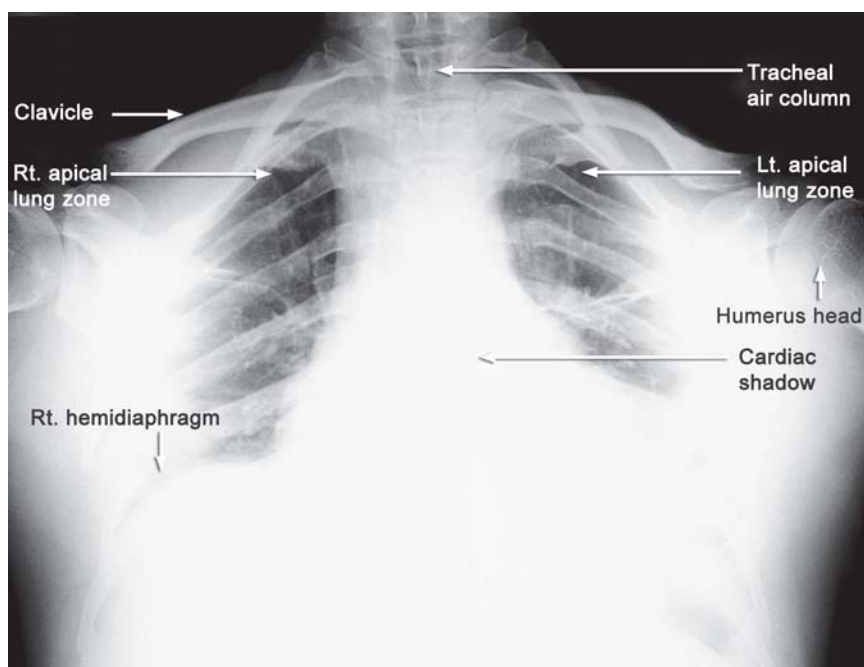


Fig. 1.4: X-ray chest – apicogram

seen in 1% of people. Apices are visualized free of ribs and clavicles on apicogram (Fig. 1.4).

Both hila are concave outwards. The pulmonary arteries, upper lobe veins and bronchi contribute to the making of hilar shadows. The left hilum is slightly higher than right hilum.

The normal length of trachea is 10 cm, it is central in position and bifurcates at T4–T5 vertebral level. Left atrial enlargement increases the tracheal bifurcation angle (normal is 60°). An inhaled foreign body is likely to lodge in the right lung due to the fact that the right main bronchus is shorter, straighter and wider than left main bronchus.

Normal heart shadow is uniformly white with maximum transverse diameter less than half of the maximum transthoracic diameter. Cardiothoracic ratio is estimated from the PA view of chest. It is the ratio between the maximum transverse diameter of the heart and the maximum width of thorax above the costophrenic angles: a = right heart border to midline, b = left heart border to midline, C = maximum thoracic diameter above costophrenic angles from inner borders of ribs. Cardiothoracic ratio = $a + b : c$. Normal cardiothoracic ratio is 1:2 (Fig. 1.5).

Borders of the mediastinum are sharp and distinct (Figs 1.2, 1.5 to 1.7). The right heart border is formed by superior vena cava superiorly and

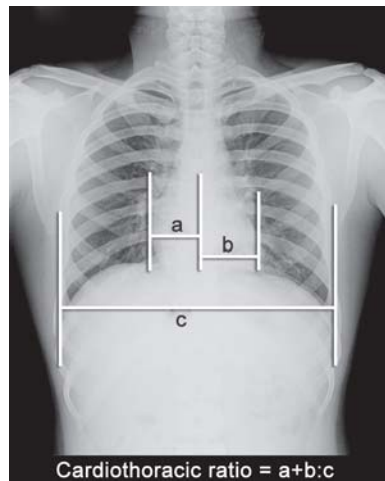


Fig. 1.5: X-ray chest PA view shows measurement of cardiothoracic ratio

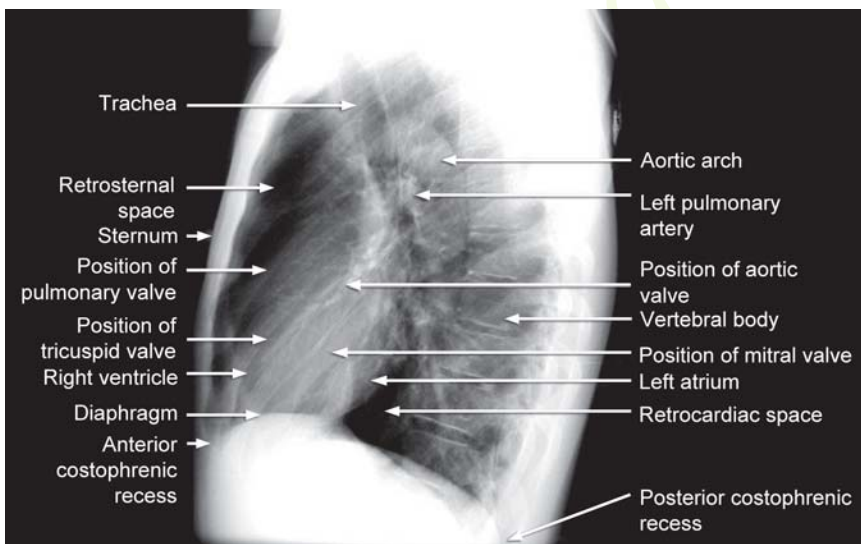


Fig. 1.6: X-ray chest lateral view

right atrium inferiorly, the left heart border is formed by the aortic knuckle superiorly, left atrial appendage and left ventricle inferiorly.

Right hemi diaphragm is higher than left. Costophrenic angles are acute angles.

To detect any pulmonary pathology, it is important to remember the normal thoracic architecture, both lungs are compared for areas of abnormal opacities, translucency or uneven bronchovascular distribution in the lungs.

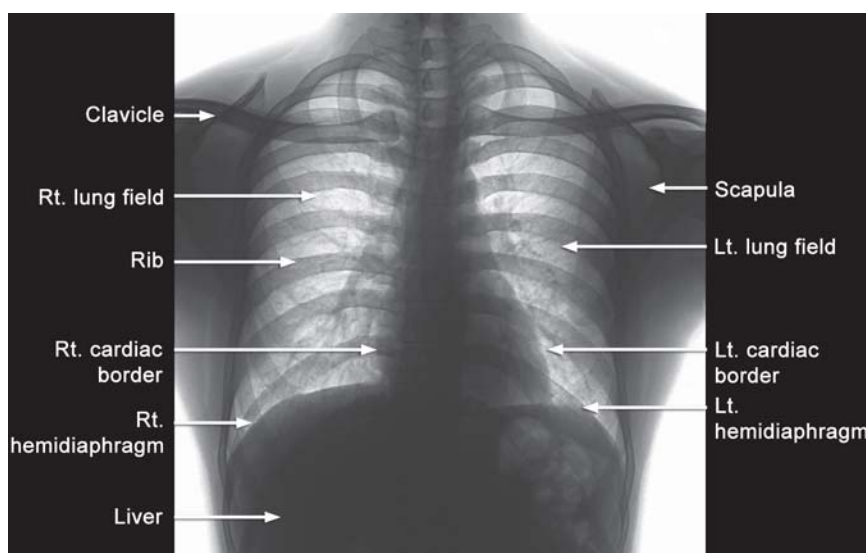


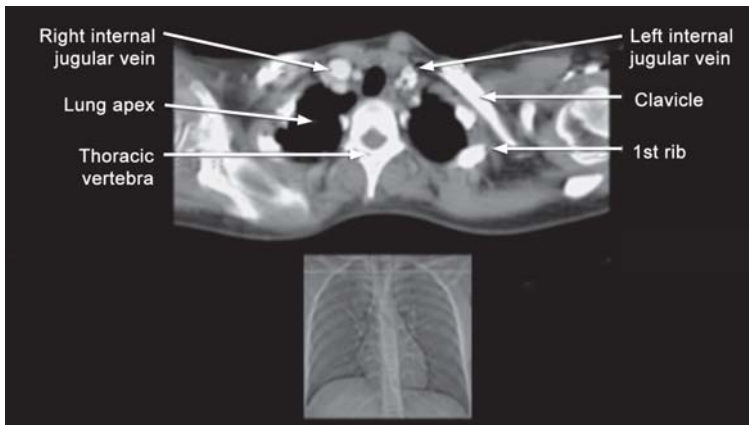
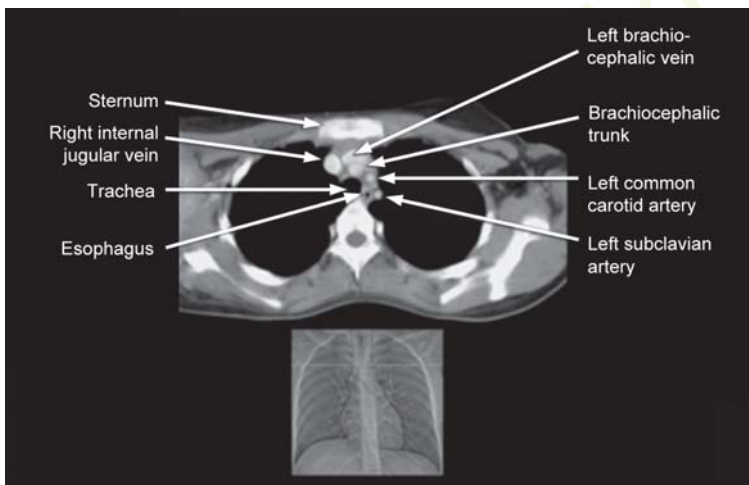
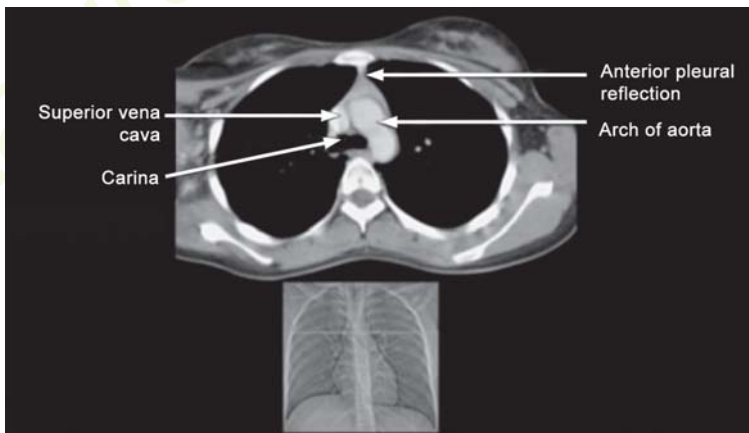
Fig. 1.7: X-ray chest PA view (negative) to visualize bony thorax

An abnormal opacity should be closely studied to ensure that it is not amalgamated opacity formed by superimposed normal structures such as bones, costal cartilages, vessels, muscles or nipple. Any opacity is evaluated by its extent, margins and location with presence or absence of calcification or cavitation. A general assessment survey is made to look for any other lesion or displacement of adjacent structures.

On CT chest, the sections are made in axial or transverse plane 8 to 10 mm in thicknesses, a miniature topogram should accompany each section or image to show the level of the sections relative to the anatomic structures at that level.

It is important to evaluate CT chest not only in soft-tissue and lung windows settings but also in intermediate windows by playing with window width and window center when considered essential specially when the lesions have intermediate densities.

The evaluation of CT chest should start with the soft tissues of the thoracic wall, the breasts and fat in the axilla (Figs 1.8 to 1.16), followed by assessment of mediastinum in soft-tissue windows. It is good to start with orientation to aortic arch (Fig. 1.10), and moving superiorly looking for any mass or node in region of the major branches of aorta, the brachiocephalic trunk, the left common carotid artery and the subclavian artery (Fig. 1.9). The brachiocephalic veins, superior vena cava, esophagus and trachea are also evaluated to exclude any abnormal mass lesion or deviation from normal.


Fig. 1.8

Fig. 1.9

Fig. 1.10

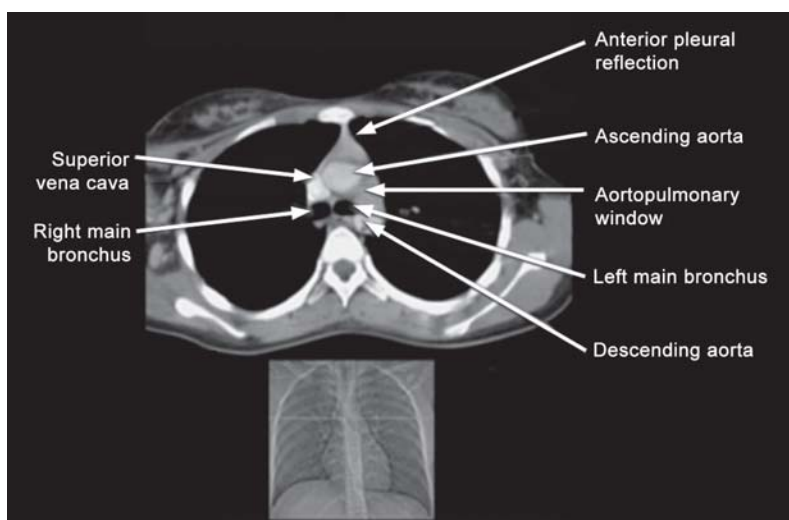


Fig. 1.11

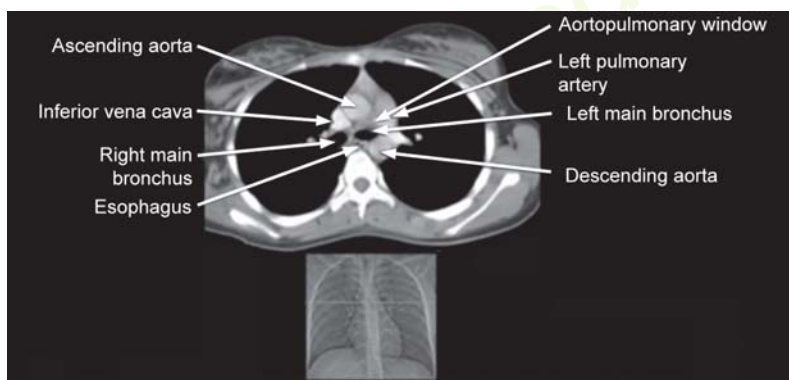


Fig. 1.12

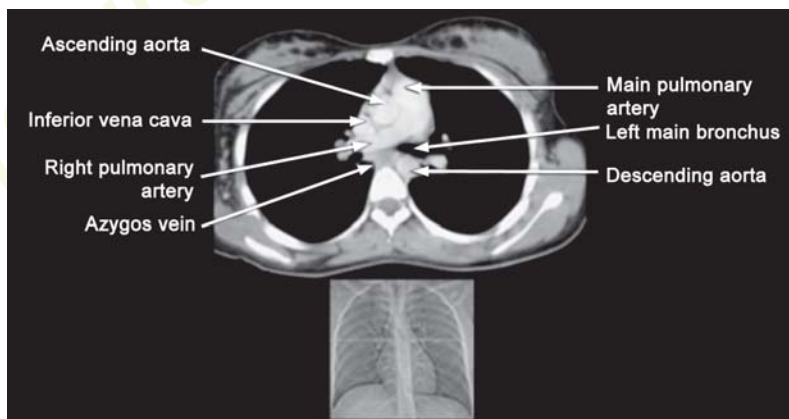


Fig. 1.13

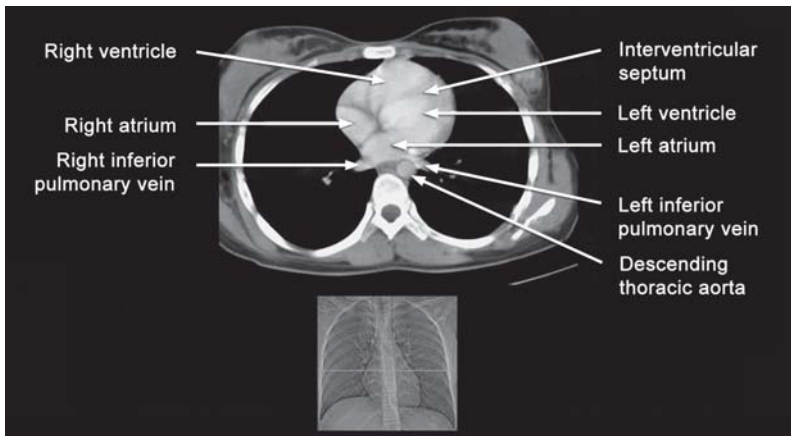


Fig. 1.14

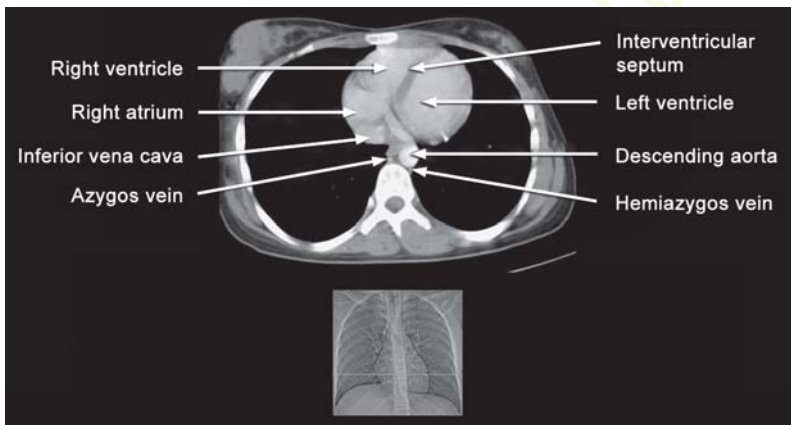


Fig. 1.15

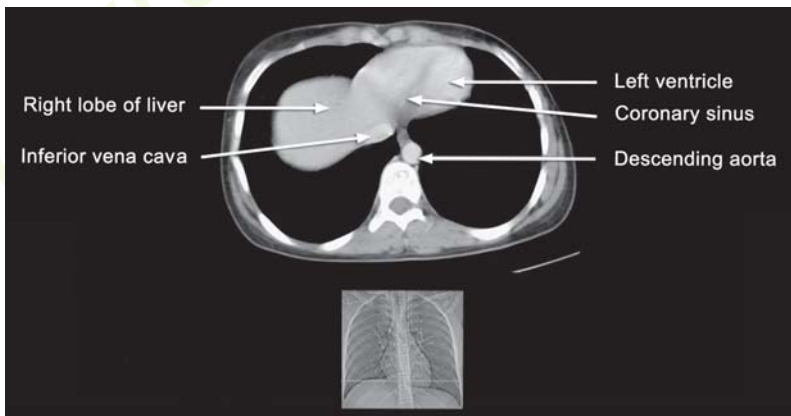


Fig. 1.16

Figs 1.8 to 1.16: Axial CT sections of chest in mediastinum window

Moving inferiorly from the aortic arch assessing aortopulmonary window (Figs 1.11 and 1.12), the tracheal bifurcation (Figs 1.8 to 1.16), the hilar and perihilar tissues (Figs 1.12 to 1.14), carefully looking for lymph nodes. The presence of less than 3 small nodes or single node measuring less than 10 mm in diameter in the aortopulmonary window can be considered normal. Heart is examined for any ventricular aneurysm or coronary calcification (Figs 1.14 to 1.16).

The right ventricle lies anteriorly, posterior to the sternum and the right atrium lies on the right lateral side (Figs 1.14 and 1.15). The left ventricle lies on the entire left side (Figs 1.14 to 1.16), the outlet of the left ventricle and the ascending aorta lie in the center of the heart. The left atrium is the most posterior chamber of the heart. The pulmonary veins join the left atrium posteriorly (Fig. 1.14). The inferior vena cava is seen further caudally just at the section the diaphragm appears together with the upper part of liver (Fig. 1.16).

The azygos vein lies dorsal to the trachea adjacent to esophagus; it arches as azygos arch above the right main bronchus and drains anteriorly into the superior vena cava.

Just caudal to aortic arch lies the pulmonary trunk, which divides into the right and left pulmonary arteries, at the level lies the aortopulmonary window. Inferior to the level of aorta the tracheal bifurcation takes place into right and left main bronchus. The aortopulmonary window and subcarinal region have predilection for mediastinal lymph nodes or malignant masses.

Now the lung parenchyma, ribs and other bony structures are assessed. The pattern of the pulmonary vasculature is scrutinized on the lung windows (Figs 1.17 to 1.28). The lungs show negative density values in

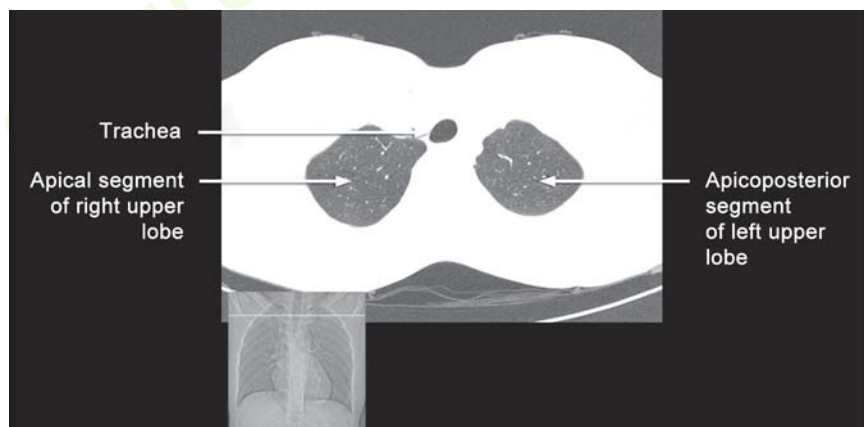


Fig. 1.17

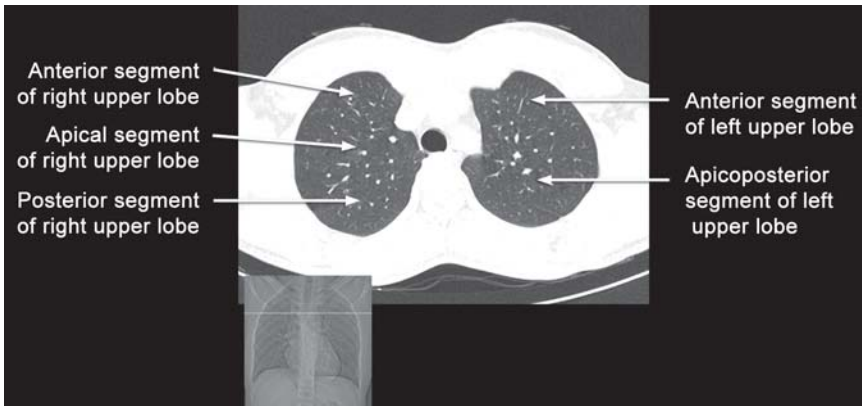


Fig.1.18

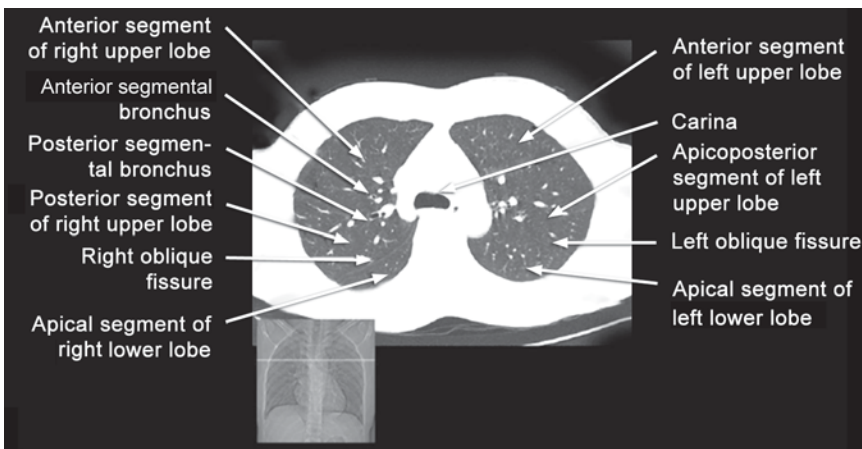


Fig.1.19

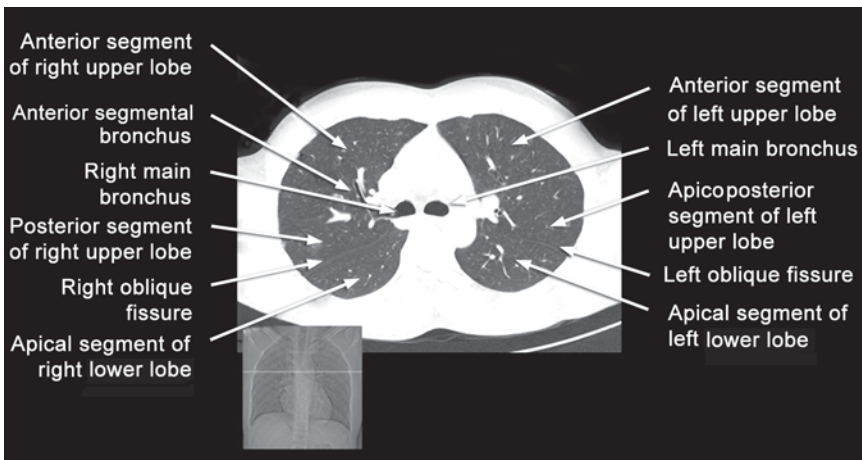


Fig.1.20

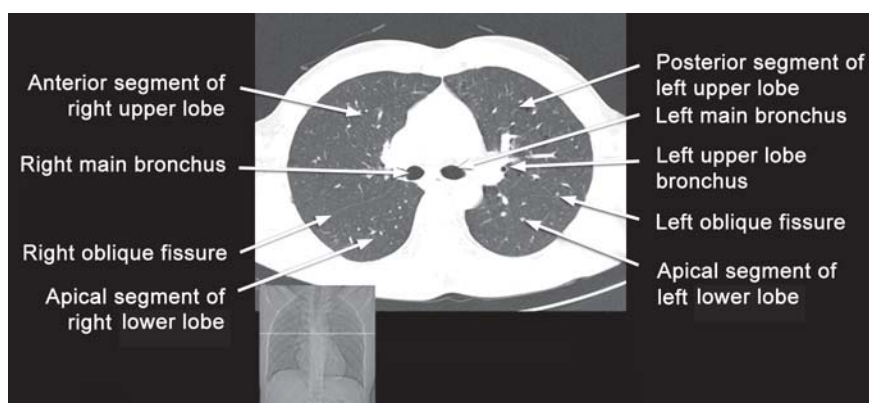


Fig. 1.21

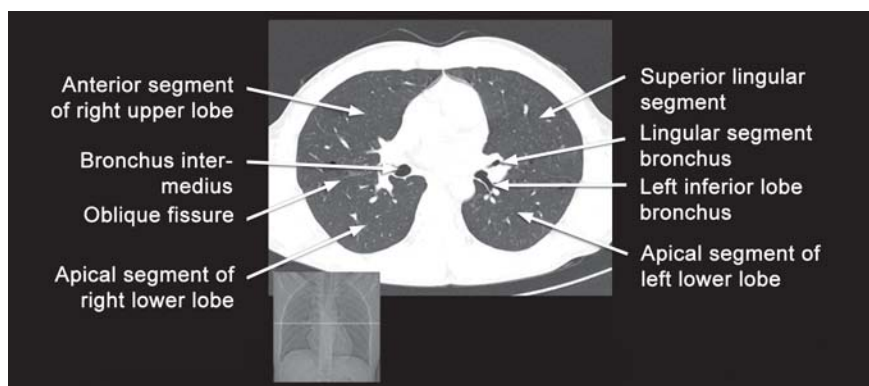


Fig. 1.22

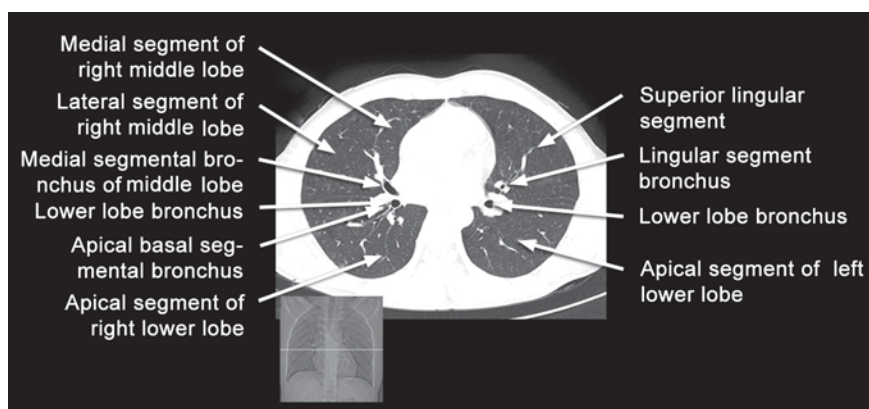
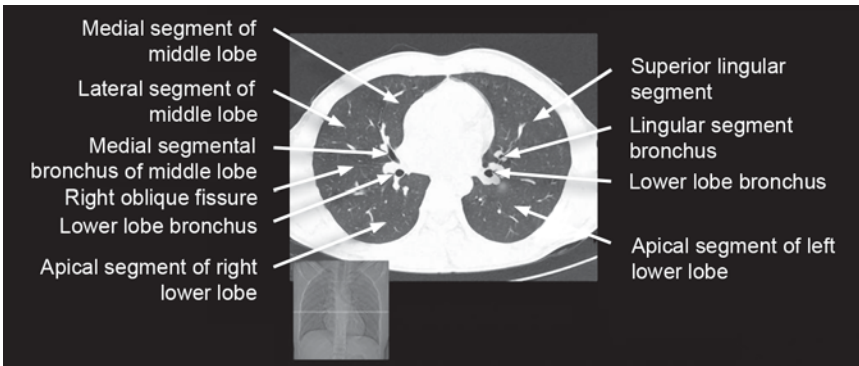
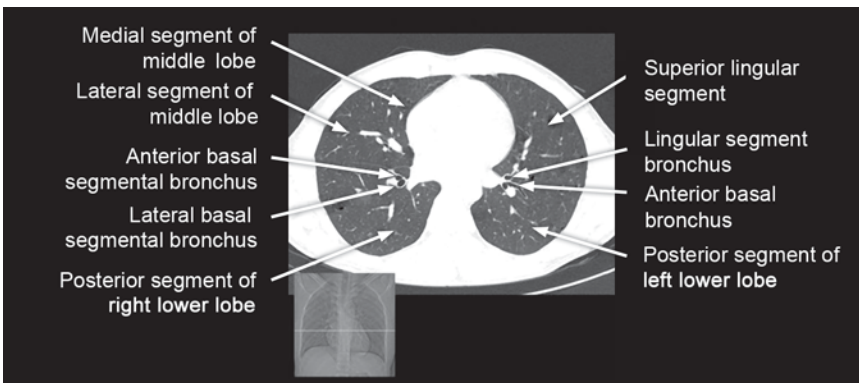
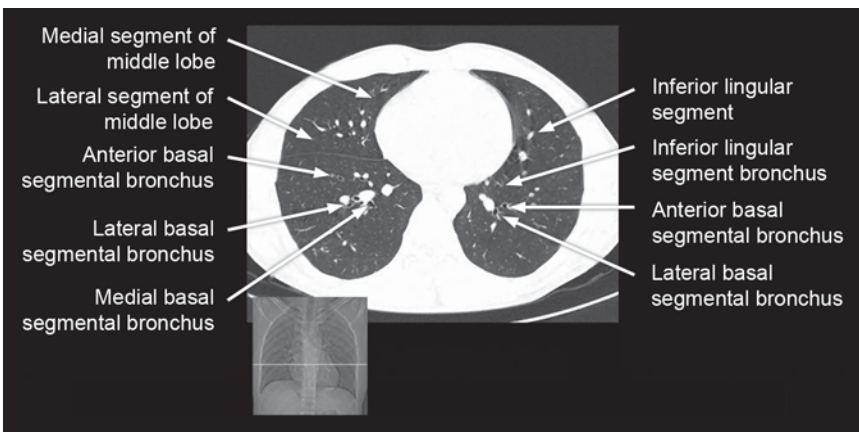


Fig. 1.23


Fig. 1.24

Fig. 1.25

Fig. 1.26

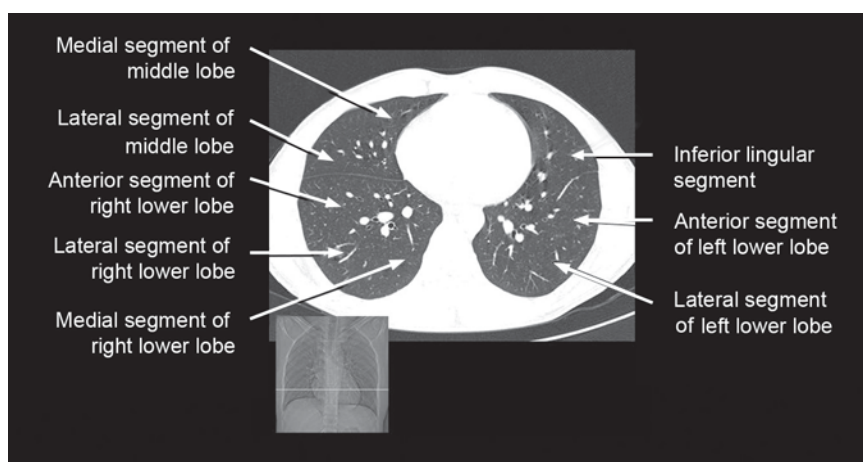


Fig. 1.27

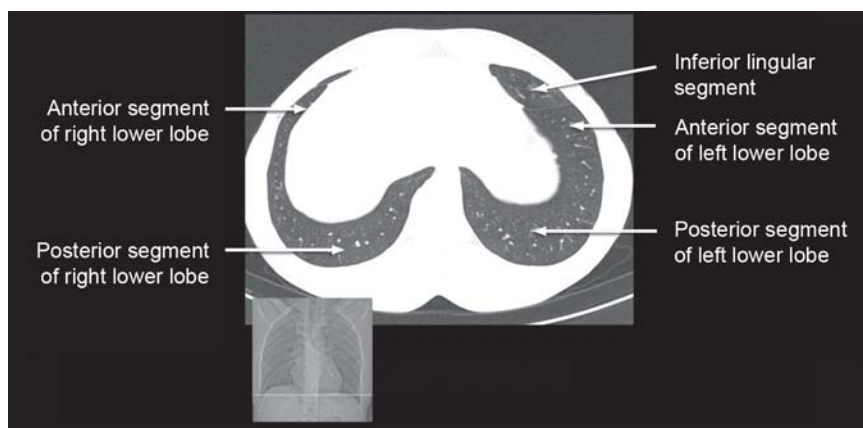


Fig. 1.28

Figs 1.17 to 1.28: Axial CT sections of chest in lung window

the Hounsfield range. The pulmonary vasculature continues from the hilum to the periphery with steady decrease in their thickness with relative oligemia in the periphery and along the margins of the lobes.

Just caudal to aortic arch lies the pulmonary trunk, which divides into the right and left pulmonary arteries, at the level lies the aortopulmonary window. Inferior to the level of aorta, the tracheal bifurcation takes place into right and left main bronchus. The aortopulmonary window and subcarinal region have predilection for mediastinal lymph nodes or malignant masses.

The pattern of the pulmonary vasculature is scrutinized on the lung windows. The lungs show negative density values in the Hounsfield range.

How to Read a Chest X-ray

Chapter

2

Aditi Dongre

Chest X-ray is exposed with the patient standing erect and facing the cassette (film) with chin up and shoulder rotated forward in order to displace scapulae from covering the lung fields. Exposure is made on full inspiration. The breasts should be compressed against the film to prevent them obscuring the lung bases. For chest exposure usual factors are 60–80 kVp and 10 mAs keeping the focal film distance (FFD) of 180 cm (6 feet) to minimize magnification, centering is done at thoracic 5 vertebral level.

A good X-ray chest film should be exposed in adequate inspiration because in an expiratory film the heart appears larger and lung basal shows increased opacities due to overcrowding of normal vascular markings. It should be a well-centered film implying that medial end of both clavicles are seen equidistant from spine at thoracic 4–5 vertebral level and trachea is in midline. Tracheal translucency decreases caudally with maximum width of translucency in female 21 mm and in male being 25 mm. With proper centering two-third of heart is on left side and one-third of heart is on the right side of the spine.

In optimum exposed the spinous processes of vertebrae are visible up to 4th thoracic vertebra. The vertebral bodies and disc spaces should be just visible up to 9th thoracic vertebral level through the cardiac shadow.

The mediastinum outline should be sharp and margins should be inspected for abnormality in shape, position and contour, the left hilum is higher than the right, both are equally dense, clearly defined, and similar in size and concave laterally. Hilum is mainly formed by pulmonary artery and vein.

Right dome of diaphragm is higher than the left up to 3 cm because the heart depresses the left diaphragm downwards. The upper border of entire diaphragm is clear except on left side where heart parks itself on the diaphragm. On loss of this clear outline, one should suspect consolidation or pleural effusion. Normally the margin of right hemidiaphragm is between anterior ends of 5th to 7th ribs, deviation from this represents

over or under inflation. Costophrenic angles should be sharp and acute; they may obliterate due to fat pads. Under left hemidiaphragm the gastric gas is seen.

Horizontal fissure extends from hilum to 6th rib in mid-axillary line as seen on frontal chest X-ray. On lateral film, the oblique fissure extends from posterior thoracic 4–5 vertebral level, through hilum to the costophrenic angle. On left side the oblique fissure is steeper and ends 5 cm behind costophrenic angle and on right side it ends just behind costophrenic angle.

Azygos lobe is an accessory lobe in the RUL. It forms when the azygos vein fails to migrate to the apex of the lung but courses through the lung during fetal life, drawing with it the parietal and visceral pleura. These four layers of pleura form the azygos fissure, and the lung tissue separated from the rest of the lung is called the azygos lobe. If the accessory lobe is seen on left side in LUL, then it contains hemiazygos vein. Left side accessory lobe is rare. Thymus is sail shaped in infants and young children projecting from one or both sides of mediastinum.

In erect posture, lower lobe vessels are larger than upper lobe vessels. Generalized change in vascular architecture (plethora or oligemia) is commonly seen in cardiac diseases. Both lung fields are scrutinized for any abnormal opacity or translucency. One should see below the diaphragm for any gas under diaphragm, dilated bowel loops, displaced gastric bubble or any calcification. Soft tissues are examined for any abnormality, like presence of subcutaneous emphysema or absence of breast shadow due to surgery. Bones (sternum, clavicle, scapulae, ribs and spine) are analyzed for any deformity, fracture or rib notching.

Lateral view of chest is exposed with shoulders parallel to the film with arms elevated or displaced back. Lesions obscured on PA view are often clearly seen on lateral film, e.g. anterior mediastinal masses, encysted pleural effusion, and posterior basal consolidation.

Retrosternal space is about 3 cm of translucency which is obliterated in anterior mediastinal masses like thymoma, widening occurs in emphysema.

On lateral film, the trachea passes down slightly posterior to dorsal 6 and 7 vertebral levels and is partly overlapped by scapula and axillary folds. Right pulmonary artery is anterior to carina and left pulmonary artery is posterosuperior to carina. Post wall of trachea is less than 5 mm in thickness and includes tracheal wall, esophageal wall and pleura; it can be widened with disease of any of them. Right upper lobe bronchus is seen end on as circular structure over lower trachea, left upper lobe bronchus can be seen just inferior to it. Posterior costophrenic angle is acute, minimum amount of pleural fluid is first detected by blunting of this angle.

Chest Wall

Sushil Kachewar

EVALUATION OF CHEST WALL

When an X-ray chest is evaluated, it is important to look for any lesion in the soft tissue over the entire available film. It may be in the form of enlarged thyroid gland, cervical or axillary lymph nodes, neurofibroma, surgical emphysema, or one of the breasts might have been surgically excised. A lesion in the breast is not picked up by X-rays unless there is calcification in the lesion, however, in female the normal breast parenchyma on CT has irregular contours with finger-like, lean extensions into the surrounding fat. Bizarre shapes of breast are often seen. Advanced stages of breast cancer show a solid and irregular appearance. The malignant tissue may be seen to cross the fascial planes or infiltrate the thoracic wall, depending on size on CT.

X-ray chest is further evaluated and it is important to look for any lesion in the bony cage and other bones visible on the film, i.e. ribs, vertebrae, clavicles, humerus, scapulae and look for a localized or generalized lesion in the form of congenital anomaly, fracture, exostosis, multiple myeloma, plasma cytoma or any other benign or malignant bone lesion.

While viewing X-ray chest it is important to see the contour of the diaphragms, any lesion below the diaphragm in the form of air under the domes of diaphragm, enlarged spleen or liver or a mass in the stomach appreciated in presence of gastric air bubble.

Case 1

A 64 years old male came to radiology department for X-ray chest with history of cough and cold.



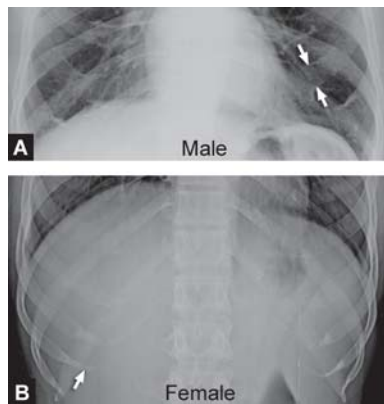
Fig. 3.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 3.1) shows normal lung fields with normal cardiac configuration. Calcification of upper and lower margins of costal cartilages is seen.

COMMENTS AND EXPLANATION

Calcification of upper and lower margins of costal cartilages is seen in male (Fig. 3.2A). However, in females the calcification of costal cartilages is seen as solid tongue like protrusion with beak towards the sternum (Fig. 3.2B).



Figs 3.2A and B

OPINION

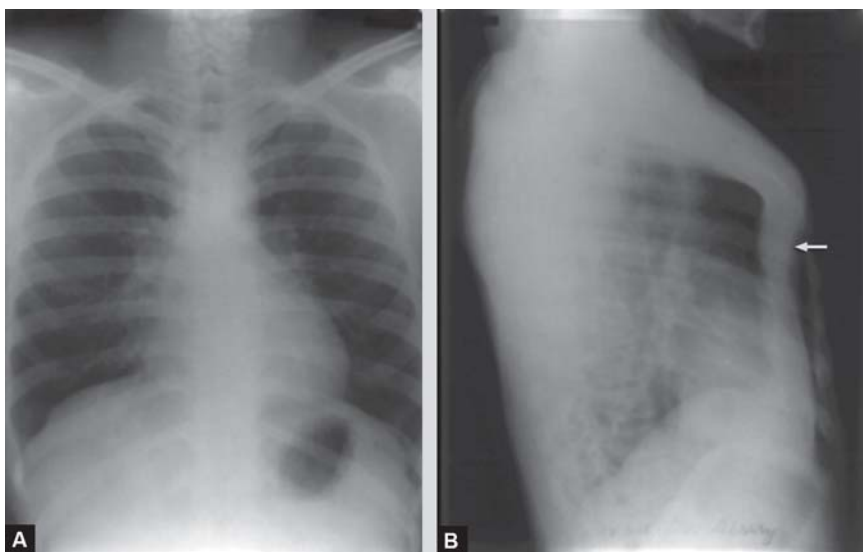
X-ray chest is normal in appearance. The pattern of calcification of costal cartilages seen is specific for males.

CLINICAL DISCUSSION

Costochondral calcifications may be seen above the age of 20 years in male and 16 years in female. They are marginal in males and central in females. The configuration of costal cartilage calcification helps to determine the sex. This information can be of use in medical jurisprudence.

Case 2

A 48 years old male came to radiology department for X-ray chest with history of cough over several days.



Figs 3.3A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest PA and lateral view (Figs 3.3A and B) show depressed sternum or pectus excavatum (arrow), otherwise lung fields are clear.

COMMENTS AND EXPLANATION

Pectus excavatum or depressed sternum is a congenital condition in which the sternum is caved-in along with the ribs and on X-ray chest the heart may be a little more on right side because of rotation. It can be present at birth. It is also known as cobbler's chest, sunken chest or funnel chest. In this, the anterior ribs being more vertical and the posterior ribs being horizontal than normal. Pectus excavatum is sometimes considered to be cosmetic; but may develop cardiac and respiratory symptoms. The heart may be displaced or rotated and base lung capacity may be decreased.

OPINION

Pectus excavatum.

CLINICAL DISCUSSION

Pectus excavatum, also known as sunken or funnel chest is a congenital chest wall deformity in which several ribs and the sternum grow abnormally, producing a concave, or caved-in, appearance in the anterior chest wall. It is a common type of congenital chest wall abnormality (90%), followed by pectus carinatum (5–7%), cleft sternum, pentalogy of Cantrell, asphyxiating thoracic dystrophy, and spondylothoracic dysplasia. Pectus excavatum occurs in an estimated 1 in 400 births, with male predominance (male-to-female ratio of 3:1). The condition is typically noticed at birth, and more than 90% of cases are diagnosed within the first year of life. Patients younger than 10 years do not typically experience symptoms associated with shortness of breath and tend to become symptomatic during their teenage years or in early adult life.

No effective nonoperative management strategies can correct of severe pectus excavatum.

The operative treatment of pectus excavatum had been fairly well-standardized and is based on the open operation originally described by Ravitch in 1949. Surgery is indicated only if the patient develops cardio-pulmonary impairment. The most common goal in operative repair of pectus excavatum is to correct the chest deformity. The desire to improve the appearance of the chest is also considered an appropriate medical indication for surgery, especially in young patients.

Case 3

A 25 years old male came to radiology department for X-ray chest with history of cough over few days.

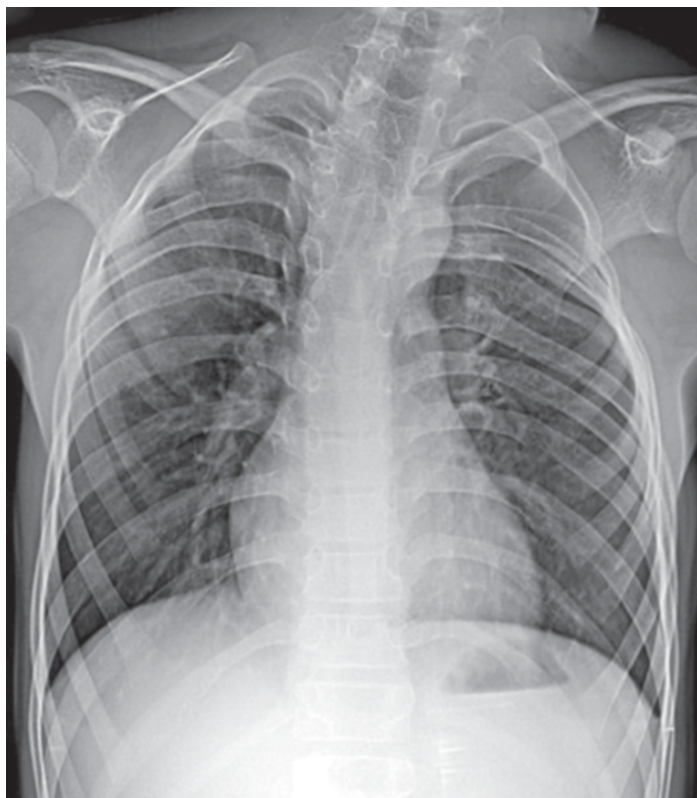


Fig. 3.4

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 3.4) shows Sprengel deformity on left side, 2nd dorsal vertebra is hemivertebra with bilateral 3rd and 4th bifid ribs on both sides.

COMMENTS AND EXPLANATION

Sprengel deformity is failure of descent of scapula secondary to fibrous or osseous omovertebral connection; it may be associated with Klippel-Feil syndrome, renal anomalies, and webbed neck. It results in elevation and medial rotation of scapula. It may be associated with Gorlin basal cell nevus syndrome.

OPINION

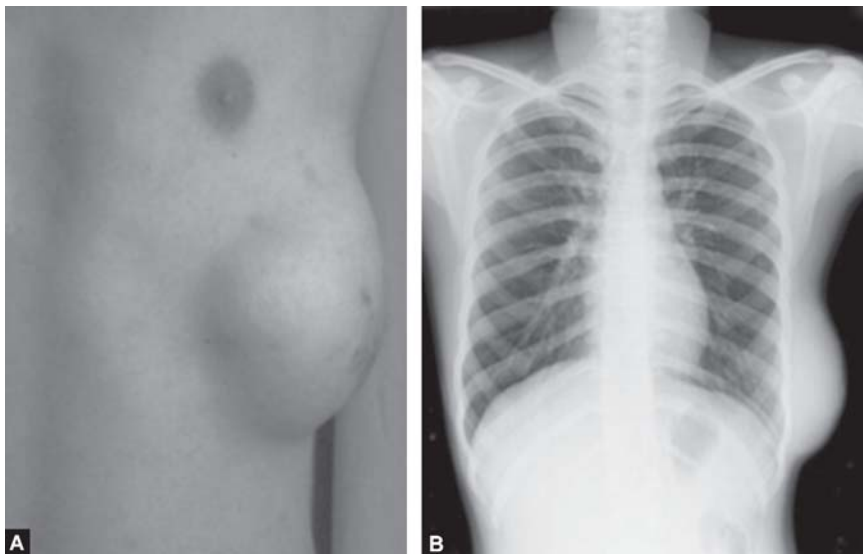
Sprengel deformity.

CLINICAL DISCUSSION

Sprengel described 4 cases of upward displacement of the scapula in 1891 and named the entity as Sprengel deformity. It is also known as high scapula or congenital high scapula. It is a rare congenital skeletal abnormality where one shoulder blade sits higher on the back than the other. The deformity is due to a failure in early fetal development where the shoulder fails to descend properly from the neck to its final position. Treatment includes surgery in early childhood and physiotherapy.

Case 4

A 17 years old male was operated for a left lateral chest wall lesion which on histopathology was a benign cystic lesion. On 3rd postoperative day the patient developed a gradually increasing swelling under the sutures on left chest wall without pain or discharge and there was no fever. He came to radiology department for X-ray chest.



Figs 3.5A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Photograph of the large soft tissue lesion (Fig. 3.5A), and X-ray chest (Fig. 3.5B) show that lung fields are clear and a large soft tissue lesion over the chest wall under the suture which developed postoperatively and gradually increased in size without pain or discharge is suggestive of development of seroma.

COMMENTS AND EXPLANATION

Immediate preoperative X-ray chest (Fig. 3.6) shows a small benign cystic lesion over the left lateral chest wall which was operated upon.

In seroma depending on the volume of collection and duration of leakage, it may take a few weeks to resolve with aspiration of serum with pressure dressing. Conservative management is usually effective. If a serum or leak does not resolve, it may be necessary to place a suction drain into the wound.

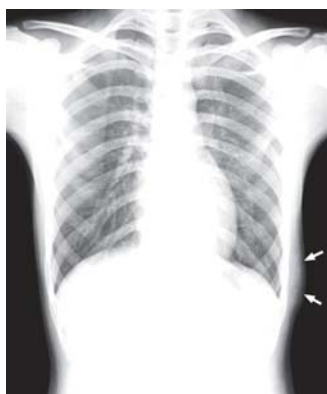


Fig. 3.6

OPINION

Seroma chest wall.

CLINICAL DISCUSSION

Seroma is a pocket of clear serous fluid that sometimes develops following surgery, blood plasma seep out of ruptured small blood vessels and the dying injured cells resulting in fluid collection. It is different from hematoma which contains blood cells, and from abscess which contains pus as a result of infection.

Seromas are sometimes seen after mastectomy, abdominal surgery and plastic surgery. It can also result following an injury. The serous fluid in the seroma is gradually absorbed over a time (often taking many days or weeks); a knot of calcified tissue sometimes remains.

Case 5

A 36 years old male came to radiology department for X-ray chest with history of cough since one week.



Fig. 3.7

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On X-ray chest (Fig. 3.7), lung fields are clear, however, there are a string like linear high density calcified guinea worms in the right axillary soft tissues.

COMMENTS AND EXPLANATION

X-ray right knee (Fig. 3.8) was done which shows calcified guinea worms in the soft tissues of the distal posterior aspect of thigh. Guinea worm disease (Dracunculiasis) has been eradicated from Asia. In India, the last reported case was in July 1996 and on completion of three years of zero incidences, India was declared free from guinea worm disease. In this case, infestation must have taken place before eradication.



Figs 3.8A and B

OPINION

Calcified guinea worm.

CLINICAL DISCUSSION

Transmission of dracunculiasis has been eradicated all over the world except only a few African countries. Man acquires infection by drinking

water containing infected cyclops. In the stomach these cyclops are digested by gastric juice and the parasites are released. They penetrate the duodenal wall; migrate through viscera to the subcutaneous tissues of the various parts of the body. They grow into adults into 9–12 months. The female grows to a length of 55–120 cm, and the male is very short 2–3 cm. After infestation many of these parasites (usually gravid female, as male dies) emerge out through the skin, while few of them are lodged in the subcutaneous tissues, die, get encapsulated and get calcified as string like appearance. Upon contact with water, the female parasite releases up to one million, microscopic larvae which remain active in water for 3–6 days. They are picked up by small crustaceans called cyclops. The larvae require a period of about 15 days for development in cyclops, which is the intermediate host.

Case 6

A 44 years old female came to radiology department for X-ray chest with history of lump in left breast.



Fig. 3.9

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 3.9) shows absence of right breast which has been surgically excised fifteen months back being a case of carcinoma breast. No lung parenchymatous lesion seen.

COMMENTS AND EXPLANATION

X-ray chest is not capable to detect breast lumps, as the lump and breast tissue have same density. CT chest (Fig. 3.10) was performed and is the imaging modality of choice. CT scan chest shows two large solid irregular marginated lesions seen in the left breast parenchyma, infiltrating into the adjacent fat and pectoralis muscles (arrow) with thickening of the skin. Right breast also shows two small nodular lesions in the parenchyma infiltrating into the adjacent fat. Left side nipple is retracted. Nodular metastatic lesion is seen in right lung. Malignant pleural effusion is present on right side. CT shows carcinoma left breast and recurrence in right breast with metastases.

Availability of baseline CT after mastectomy helps in early identification of recurrent tumor which often becomes difficult by fibrosis after radiation, postoperative scar tissue, and poor surrounding fat. Regional lymph nodes and bones, including vertebrae should be carefully examined such that metastases are not overlooked.



Fig. 3.10

OPINION

Carcinoma breast (operated).

CLINICAL DISCUSSION

On general survey of X-ray chest to see the soft tissues should include breast shadows, chest wall, shoulders and lower neck. It is important to confirm the presence or absence of breast shadows. The breasts may partially obscure the lung bases. Nipple shadows are sometimes viable in position, often asymmetrical, and frequently only one shadow is seen. Care is necessary to avoid misinterpretation as a neoplasm or vice versa. Nipple shadows are often well-defined laterally and may have a lucent halo. Repeat films with nipple markers are necessary if there is any doubt.

Case 7

A 13 years old male came to radiology department for X-ray chest with history of cough for one month.

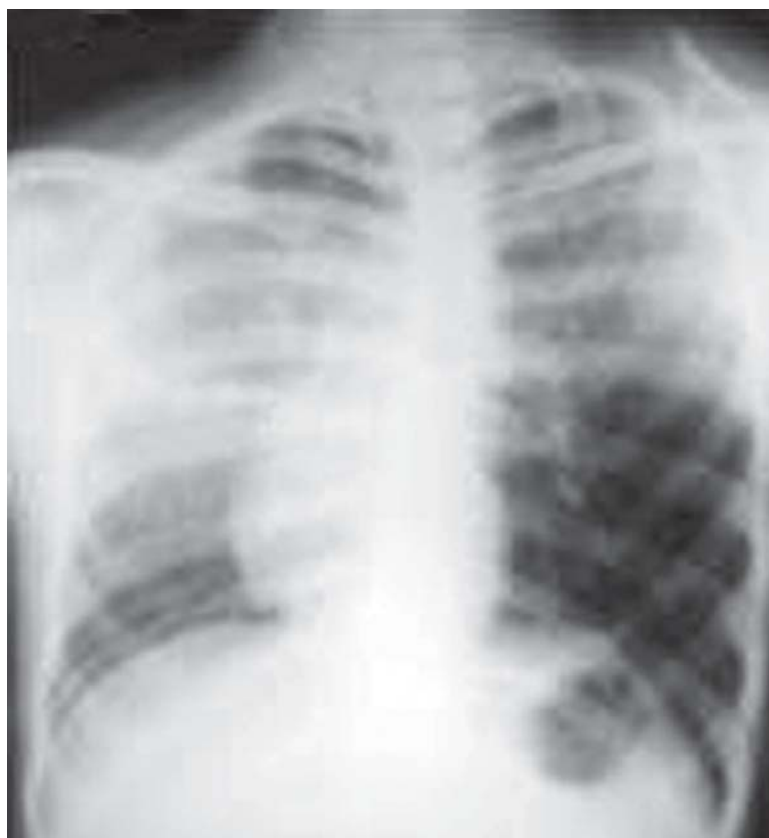


Fig. 3.11

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 3.11) shows relative translucency of left hemithorax (or increased whiteness of right hemithorax) with mild scoliosis and pseudodextrocardia. CT scan chest was advised.

COMMENTS AND EXPLANATION

CT chest (Fig. 3.12) shows deficient muscle mass (pectoralis major muscle) in left hemithorax (white arrow) as the cause of abnormal X-ray chest and was diagnosed as Poland's disease. The pectoralis muscle mass is normal on right side (black arrow). However, the commonest cause of translucent hemithorax with normal axillary fold, if it is a simple mastectomy.



Fig. 3.12

OPINION

Poland's syndrome.

CLINICAL DISCUSSION

In Poland's syndrome the etiology is not known and is described as an absence or hypoplasia of the pectoralis muscle on one side of the body with cutaneous syndactyly (webbing of the fingers) of the hand on the same side. Rib anomalies may also be associated. It is a rare congenital condition.

The severity of Poland's syndrome is variable and is often not diagnosed. Poland's syndrome is three times more common in males and affects the right side of the body twice as often as the left. The reasons for these differences are unknown, so is the cause.

Case 8

A 56 years old female came to radiology department for X-ray chest with history of hypertension and pain in chest.

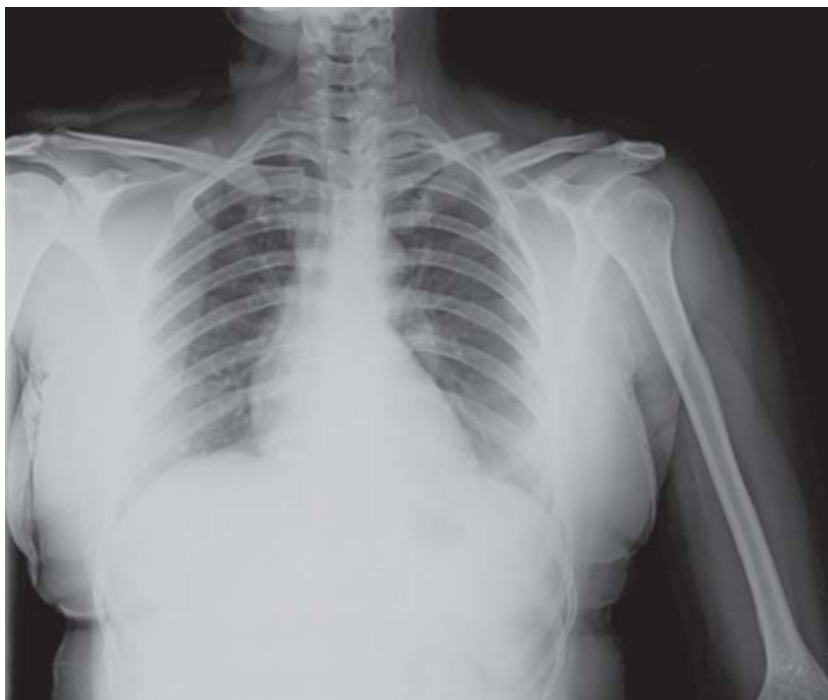


Fig. 3.13

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 3.13) shows normal lung fields. The examination of the film is not complete until the bones and soft tissues have also been surveyed. There is a fracture through the mid diaphysis of left clavicle with overlap of the bony fragments.

COMMENTS AND EXPLANATION

In evaluation of X-ray chest, it is important to look for any lesion in the bony cage and other bones visible on the film, i.e. ribs, vertebrae, clavicles, humerus, scapulae and look for a localized or generalized lesion in the form of congenital anomaly, fracture, exostosis, multiple myeloma, plasmacytoma or any other benign or malignant bone lesion.

OPINION

Fracture left clavicle.

CLINICAL DISCUSSION

Once the fractures of the clavicle is seen on X-ray chest, it is important to look for any associated injury to the subclavian vessel or brachial plexus, and posterior dislocation of the clavicle at the sternoclavicular joint may cause injury to the trachea, esophagus, great vessels or nerves of the superior mediastinum.

Case 9

A 40 years old female came to radiology department for X-ray chest with history of cough for seven days.



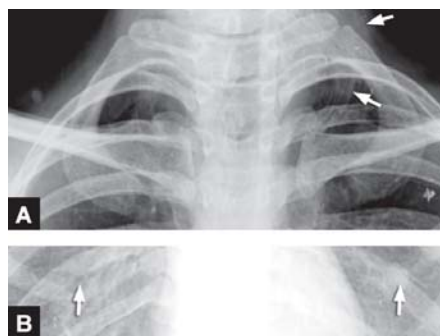
Fig. 3.14

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 3.14), lung fields are clear, a small rounded shadow in left lower zone which is well-defined at the level of 5th rib anteriorly. Another small rounded shadow of similar size, similarly positioned is seen on the right side, it is, however, less dense. These are bilateral nipple shadows. In addition to this the left apex shows linear streaky shadows curved medially, if these shadows are traced upwards they are seen to continue outside, these linear shadows are due to plait of hairs.

COMMENTS AND EXPLANATION

Magnified views (Figs 3.15A and B) are provided to show the plait of hairs and nipple shadow better. Nipple shadow is a normal structure with characteristics position, size and features and this aid in the interpretation of solitary or two nodular shadows. Nipple shadows can be seen in up to 6% of chest radiographs of females over 35 years of age.



Figs 3.15A and B

OPINION

Nipple shadows.

CLINICAL DISCUSSION

Nipple shadows are frequently bilaterally symmetrical. They may have well-defined or fuzzy margins with radiolucent halo, or sharp lateral but poorly-defined medial margins. Their characteristic location is fifth or sixth anterior ribs. Most of these can be resolved as 'classic nipple shadows' and no further imaging is needed, about 1.4% need repeat examination. Nipple markers are very helpful to determine whether the suspicious nodule is actually a nipple shadow, or not. Possibility of having a true pulmonary nodule lying beneath the nipple shadow is very low.

Visible male nipple shadows are not rare and need to be differentiated from solitary nodular shadows in the lower lung field.

Case 10

A 54 years old male came to radiology department for X-ray chest with history of a large painless chest wall swelling on right side, present over last seven years and gradually increased to present size. It was soft in consistency and non-adherent to the underlying ribs.



Fig. 3.16

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 3.16) shows a homogeneous soft tissue mass lesion without any calcification arising from the right lateral chest wall. The underlying ribs are normal; they show no erosion or pressure effect. History, clinical finding and X-ray chest are suggestive of lipoma.

COMMENTS AND EXPLANATION

Ideally, CT is important as it provides a definitive diagnosis of lipoma but the patient failed to report back after chest X-ray. Most chest wall lipomas that originate are superficial, in this case arising from right posterolateral chest wall (Fig. 3.17).

On CT and MR lipomas appear homogeneous and show no contrast enhancement, it may have multiple thin septa which may enhance on contrast CT and have low signal intensity on fat-suppressed T1-weighted MR images. Spindle cell lipoma is a rare, painless, and slow-growing neoplasm in which mature fat cells are replaced by collagen-forming spindle cells.

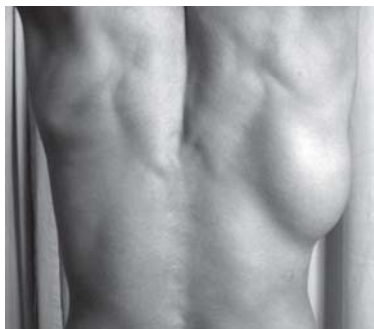


Fig. 3.17

OPINION

Lipoma chest wall.

CLINICAL DISCUSSION

Lipomas are well-defined encapsulated mass lesions made up of adipocytes very similar to normal fatty tissue generally seen between 50–70 years of age. Lipomas that originate in the chest wall may be superficial or deep extending into the chest.

In chest, lipoma may be seen in the mediastinum though very uncommon. Then there are cardiac lipomas, they are the second most common benign cardiac tumors, their origin can either be epicardial, endomyocardial or subendocardial in location, most common in relation to left ventricle and right atrium.

Case 11

An 87 years old male came to radiology department for X-ray chest with history of bone pains, lethargy and cough.

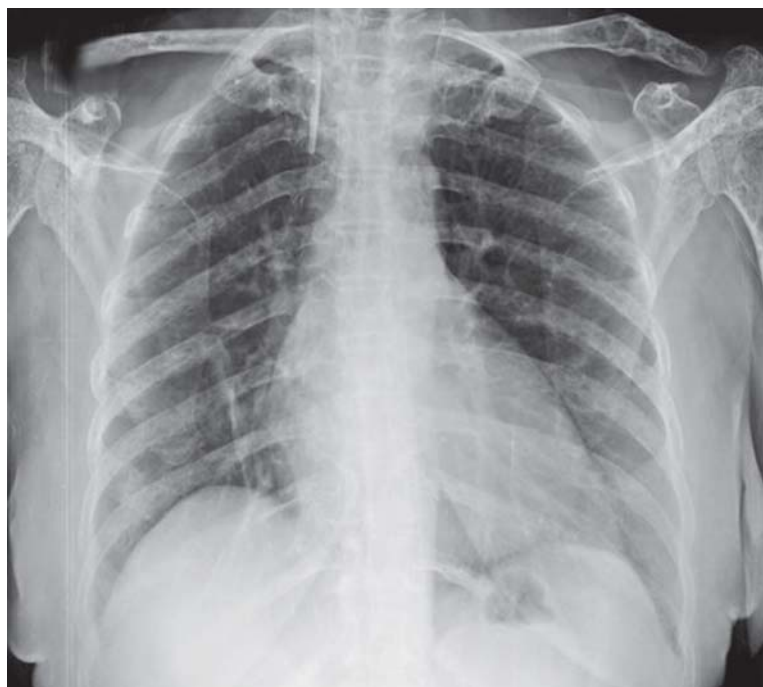


Fig. 3.18

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On chest X-ray (Fig. 3.18), the ribs show generalized reduction in bone density with wide spread destructive foci. The lesions are more prominent and larger in size in the left clavicle and proximal part of humerus. In view of destructive bone lesions, patient was subjected to X-ray skull.

COMMENTS AND EXPLANATION

Chest X-ray (Fig. 3.19) shows prominent and large size destructive foci in the left clavicle and proximal part of humerus (arrows). X-ray skull (Fig. 3.19 inset) shows multiple wide spread osteolytic rounded circular defects of varying diameter from 2 mm to 15 mm with no surrounding bone reaction or sclerosis. The disseminated or generalized form of plasma cell infiltration of bone marrow is known as multiple myelomatosis. It is much more common for the widespread form to present radiologically as a fully developed entity over 40 years of age. Men are affected twice as common as women. Persistent bone pain or a pathological fracture is usually the first complaint.



Fig. 3.19

OPINION

Multiple myeloma.

CLINICAL DISCUSSION

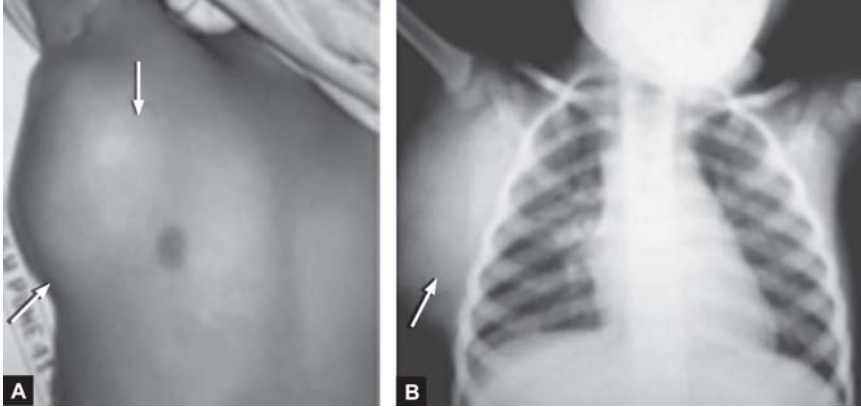
The two cardinal features in multiple myeloma are generalized reduction in bone density and localized areas of radiolucency in red marrow areas. The axial skeleton, therefore, is affected predominantly. Lesions may be observed also in the shafts of long bones and in the skull. In spite of positive bone marrow aspiration, radiological feature may be absent in as many as one third of cases, at least at the initial presentation. This group of patients tends to develop generalized osteoporosis. Fifty percent cases present with proteinuria (Bence Jones proteinuria).

Radiology plays an important part in the initial diagnosis of the disease. A radiographic skeletal survey is superior to scintigraphic investigation using a bone-scanning agent, because the lesions are essentially osteolytic with no bone reaction. The distribution of lesions is extensive and destructive. The disease will not always be evident by the presence of the classic 'raindrop' lesions, circular defects of few mm to 2 or 3 cm in diameter.

Myelomatous lesions may erode the cortex and extend into the adjacent soft tissues. The resulting soft tissue masses are helpful in differentiating the advanced form of the disease from metastatic lesions. In chest, a destructive rib lesion with a large associated soft tissue mass is much more suggestive of myelomatosis than of a plasmacytoma.

Case 12

A 3 years old child came to radiology department for X-ray chest with history of a large soft tissue mass on right side of chest.



Figs 3.20A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Photograph (Fig. 3.20A) of the child shows the soft mass (arrow), on X-ray chest (Fig. 3.20B) the soft tissue lymph nodal mass lies outside the thoracic cage in right hemithorax.

COMMENTS AND EXPLANATION

On X-ray chest the lung fields are clear, on X-ray chest it is important to look for any lesion in the soft tissue over the entire available film. It may be in the form of enlarged thyroid gland, cervical or axillary lymph nodes, neurofibroma, surgical emphysema, a lesion in the breast or one of the breasts might have been surgically excised. Ultrasound can be useful in investigating nodal masses particularly as an aid to biopsy.

OPINION

Lymph node mass.

CLINICAL DISCUSSION

CT is generally the method of choice, providing a direct and reproducible demonstration of normal and abnormal lymph nodes. MRI has potential to replace CT in the assessment of nodal disease, although at higher cost, MRI is the option during follow-up of nodal disease being radiation free. Lymph node enlargement is the hallmark of metastatic disease keeping in mind the size criteria for normal and abnormal lymph nodes have evolved in the different areas of the body.

Case 13

A 58 years old male came to radiology department for X-ray chest with history of chest pain.



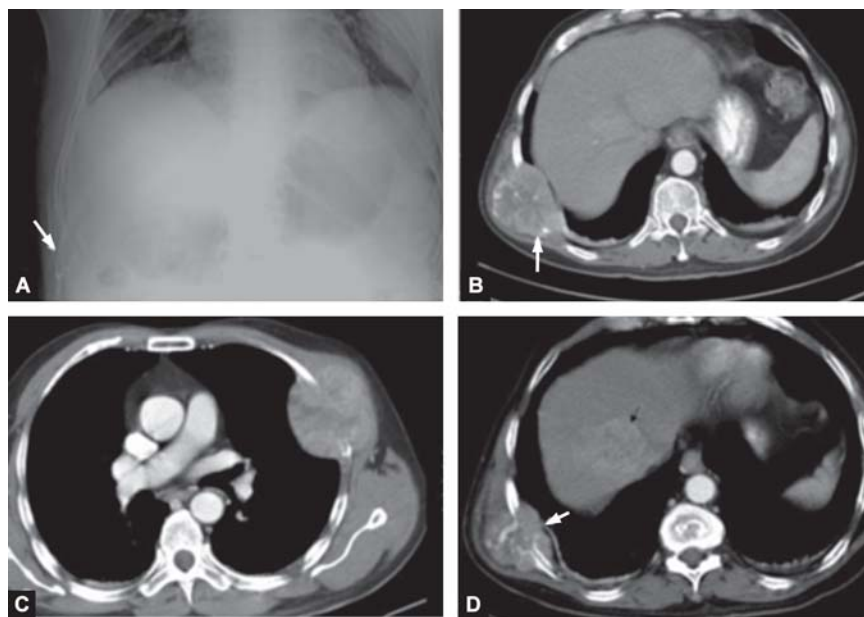
Fig. 3.21

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 3.21) shows a large (8×6 cm) well-defined mass lesion abutting the left lower chest wall with broad base towards the chest wall with partial destruction of lateral aspect of 4th rib on the left. This suggested malignant lesion. CT chest was contemplated.

COMMENTS AND EXPLANATION

Contrast CT chest (Figs 3.22A to D) was done which shows moderately enhancing metastatic bone lesion which is rounded and well-defined having a large soft tissue component from the left 4th rib, and right 10th rib (Figs 3.22B and C) laterally, the ribs are partially destroyed, few small scattered calcific densities are seen in the lesions. There is a single iso to hypodense lesion seen in liver measuring 5×4 cm. The lesion shows moderate heterogeneous post-contrast enhancement (Fig. 3.22D).



Figs 3.22A to D

OPINION

Metastasis to ribs and liver.

CLINICAL DISCUSSION

Primary tumors which originate in other organs and involve the skeletal structures of the body either by hematogenous, lymphatic route or by direct invasion are called metastasis. Metastases are generally multiple

commonly found in the axial skeleton and sites of residual red marrow. The common sites are vertebrae, pelvic bones, proximal femur and humerus, skull and ribs. It is unusual for metastasis to involve bones distal to the elbows or knees.

Osteolysis within the thoracic skeleton is frequent and is usually as a result of metastases. Other causes of osteolysis are enchondroma, eosinophilic granuloma or multiple myeloma.

In addition to destructive processes, degenerative processes involving sclerosis and osteophyte formation of bone must be differentiated from osteosclerotic metastases, which are usually from carcinoma prostate.

The common primary neoplasm which spread to bones is from breast, lungs, prostate, kidney and thyroid.

Occult primary is a primary malignancy in which there are no localizing signs suggestive of the site of primary tumor and has not been detected by any of the available investigative protocols. However, the metastatic lesions have been detected on clinical, radiological and biomedical parameters. Histopathology may suggest the likely site of primary.

Case 14

A 8 years old child was brought to radiology department for X-ray chest following an accidental fall from the roof top.

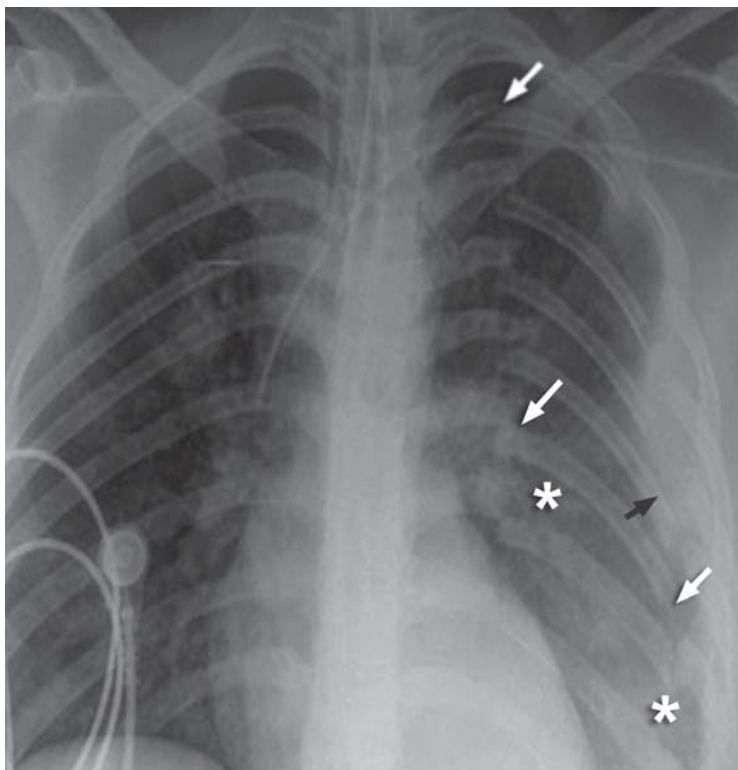


Fig. 3.23

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 3.23) anteroposterior view of chest shows 3rd to 8th rib fractures (white arrows) on left side, each at two places with encysted hemothorax (black arrow) and lung contusion (extends between the asterisks) with mediastinal pushed to the right side.

COMMENTS AND EXPLANATION

CT has clearly emerged as the primary diagnostic tool in the evaluation of the hemodynamically stable trauma patient. Contrast-enhanced spiral CT has revolutionized the workup and diagnosis of trauma patients. State-of-the art CT technology with multislice capabilities allows for rapid scanning, permitting greater coverage with greater spatial detail.

OPINION

Flail chest.

CLINICAL DISCUSSION

Flail chest is a critical condition following major blunt chest trauma in which two or more contiguous ribs are fractured at two or more places. In this condition, a segment of the thoracic cage is separated from the rest of the chest (flail segment), as a result a part of the chest wall moves freely in the opposite direction as to the rest of the chest. The related complications are pneumothorax, pleural effusion, pulmonary laceration and contusion.

CT is superior to chest radiograph for most thoracic injuries. It can demonstrate pulmonary contusion, lacerations, pneumothorax and hemothorax that may be missed on plain radiographs. Spiral CT with high resolution image acquisition followed by sagittal and coronal reconstructions clearly depict spinal and diaphragmatic injuries if associated.

Treatment includes alteration of position to make the patient most comfortable and provide relief of pain, good analgesia with intercostal block and positive pressure ventilation. Surgical fixation is usually not required.

Pleura

Varsha Rangankar

Case 15

A 26 years old executive came to radiology department for X-ray chest as part of medical checkup.



Fig. 4.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On X-ray chest (Fig. 4.1) lung fields are clear and cardiac size and configuration is normal. An upside down comma-shaped azygos vein is seen lying at the lower medial end of the azygos fissure.

COMMENTS AND EXPLANATION

Magnified view (Fig. 4.1) of azygos lobe, which is an accessory lobe, a normal variant found in less than 1% of the population. It is found in the right lung; separated from the upper lobe by a deep pleural furrow housing the azygos vein. It is a small lobe of no clinical significance and hence requires no treatment.

It forms when the azygos vein fails to migrate to the apex of the lung but courses through the lung during fetal life, drawing with it the parietal and visceral pleura. These four layers of pleura form the azygos fissure, and the lung tissue separated from the rest of the lung is called the azygos lobe. As a result, the azygos vein comes to lie at the bottom of a deep fissure in the upper lobe of the right lung. On X-ray PA view chest, the azygos vein is seen end on (Fig. 4.2) and has a comma-shaped appearance.



Fig. 4.2

OPINION

Azygos lobe.

CLINICAL DISCUSSION

Azygos lobe has no clinical significance, it is a normal variant and requires no treatment. It may be a site for consolidation or mass lesion. The azygos lobe lesion must be differentiated from pathological conditions like substernal thyroid gland, a large thymus or pleural bands. It may be simulated by lines that occupy a similar position, such as scars, walls of bullae, displaced fissures, supernumerary fissures. CT may be helpful in excluding an azygos lobe by demonstrating the azygos vein at its normal location and identifying the underlying disease. The knowledge of azygos lobe anatomy is important during thoracic surgical approach in this region.

Case 16

A 28 years old male came to radiology department for X-ray chest with history of breathlessness on exertion since 10 days.

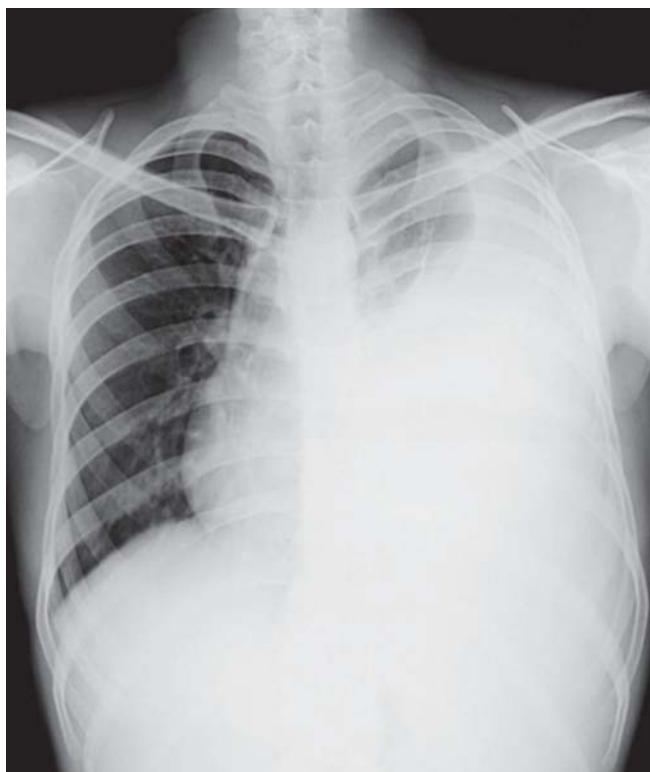


Fig. 4.3

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 4.3) shows a large pleural effusion on left side, the trachea and mediastinum are pushed to the right, right lung field is clear.

COMMENTS AND EXPLANATION

Pleural effusion is the accumulation of fluid in the pleural space, i.e. between the visceral and parietal layers of pleura. In another case (Fig. 4.4) small effusion is seen on right side. The fluid may be transude, exudate, blood, chyle or rarely bile.

Pleural fluid casts a shadow of the density of water on the chest radiograph. The most dependent recess of the pleura is the posterior costophrenic angle. A small effusion will, therefore, tend to collect posteriorly; however, a lateral decubitus view is the most sensitive film to detect small quantity of free pleural fluid (as small as 50 ml). 100–200 ml of pleural fluid is required to be seen above the dome of the diaphragm on frontal chest radiograph. As more fluid is accumulated, a homogeneous opacity spreads upwards, obscuring the lung base. Typically this opacity has a fairly well-defined, concave upper edge (Fig. 4.3), which is higher laterally and obscures the diaphragmatic shadow. Frequently the fluid will track into the pleural fissures. A massive effusion may cause complete radiopacity of a hemithorax. The underlying lung will retract towards its hilum, and the space occupying effect of the effusion will push the mediastinum towards the opposite side.

USG chest confirms the presence or absence of the pleural fluid; it also shows the septations within the pleural fluid with or without solid component within the lesion. USG helps in guiding aspiration of pleural fluid. CT scan is the most sensitive modality for detection of presence of



Fig. 4.4

minimal fluid. It allows distinction between free and loculated fluid showing its extent and localization.

OPINION

Pleural effusion.

CLINICAL DISCUSSION

Large pleural effusion often presents with shortness of breath, dyspnea, sharp chest pain worsening with a deep inspiration, cough and symptoms of underlying cause. Small effusions go unnoticed many times. In large effusion there are clinical signs such as decreased movement of chest on affected side, stony dullness on percussion over the fluid, diminished breath sounds, decreased resonance and fremitus and pleural friction rub.

Pleural effusion is either transudate or exudates. Transudative effusion is formed when fluid leaks from blood vessels into the pleural cavity such as in congestive cardiac failure, nephritic syndrome and hepatic cirrhosis. Exudative effusion is caused by the inflammation of pleura itself and is often due to lung pathology such as pneumonia, tuberculosis, lung malignancy. Whenever pleural effusion is diagnosed underlying cause should be explored to reduce further morbidity.

Therapeutic aspiration is sufficient in small effusion. Large effusions require insertion of intercostal drainage tube. In any case the underlying cause should be treated to prevent recurrence. Thoracocentesis may be needed in malignant effusion.

Case 17

A 26 years male came to radiology department for X-ray chest with history of cough and fever.

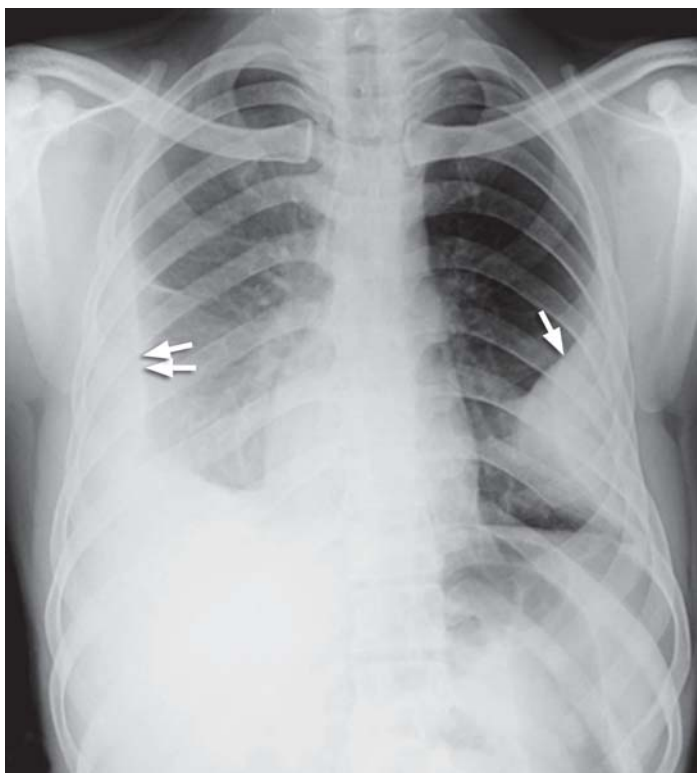


Fig. 4.5

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 4.5) shows encysted pleural effusion (arrow) along left lateral chest wall, i.e. costoparietal in position, and on right side there is free pleural effusion (twin arrow).

COMMENTS AND EXPLANATION

The chest radiographic appearance depends on the site of the loculus, the amount of fluid and the radiographic projection. When seen en face it usually appears as an oval opacity, its margin partially well-defined and partially ill defined. When viewed tangentially, it is sharply defined on its convex pulmonary aspect. In moderate and massive effusion there is significant shift of the trachea and the apex of the heart to the opposite side. In the case of encysted effusions the inner margins may be more convex and the mediastinal shift minimal. If the encystment occurs in the interlobar regions there may be formation of rounded or oval opacities which may resemble a tumor. This may disappear with treatment and hence these are termed pseudo-tumors or phantom tumors. Chest ultrasound and CT is helpful to differentiate pleural fluid and other pleural and chest wall lesions.

OPINION

Encysted pleural effusion.

CLINICAL DISCUSSION

Patient may present with dyspnea, chest pain, cough and symptoms of underlying cause. In encysted pleural effusion fluid accumulates between the two layers of visceral pleura within the fissure or between partially fused parietal and visceral pleura adjacent to chest wall, diaphragm or mediastinum. Encysted effusion can either be costoparietal, interlobar, subpulmonic or mediastinal. Costoparietal effusion is the commonest and most often results from infections. Interlobar encystment comes next in frequency and most often results from congestive cardiac failure. Tuberculosis is the commonest cause of encysted pleural effusions, followed by pyogenic infection and congestive cardiac failure. Aspiration of fluid is the treatment of choice. Ultrasound guided needle aspiration is helpful for costoparietal effusion.

Case 18

A 47 years old female came with general weakness to radiology department for X-ray chest.

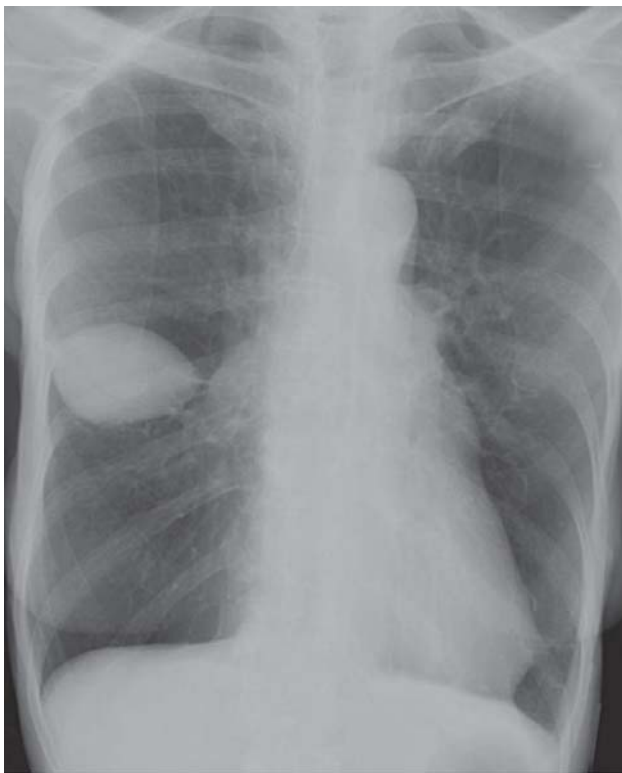


Fig. 4.6

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 4.6) shows an oval soft tissue density which overlays over most of the minor fissure. It is well-defined, no calcification seen and the surrounding lung is clear. Diagnosed as pseudotumor.

COMMENTS AND EXPLANATION

Loculation within the fissure gives appearance of a tumor and is referred as pseudotumor. The pulmonary pseudotumor is sharply margined collection of pleural fluid contained either within an interlobar pulmonary fissure or in a subpleural location adjacent to a fissure. Pseudotumors are identified on chest X-rays on their lenticular pattern. CT chest confirms a loculated effusion within the fissure with Hounsfield value that of a transudate. The pseudotumor resolved with conservative management. Most occur in the minor (horizontal) fissure and are seen on both the frontal and lateral radiograph; those that occur in the oblique or major fissure may only be seen on the lateral view. Pseudotumors may be erroneously diagnosed as parenchymal lung nodules or masses.

OPINION

Pseudotumor.

CLINICAL DISCUSSION

Pseudotumor or vanishing tumor of the lung is an appropriate designation for a localized transudative interlobar pleural fluid collection. It derives its name from its frequent resemblance to a tumor on X-ray chest and from its tendency to vanish following appropriate management. Encapsulation is due to adhesions between contiguous pleural surfaces. Therefore, it is often seen after episodes of pleuritis. The pleural encapsulation can be mistaken for pulmonary consolidation, collapse, or a mediastinal tumor. The borders of a loculated effusion are convex unlike pulmonary collapse or consolidation. There may be pleural thickening elsewhere in the thorax. It is most commonly seen in the minor fissure. The possibility of a vanishing lung tumor should be considered and excluded in any patient presenting with congestive heart failure or apparent lung mass on a chest X-ray.

Case 19

A 45 years old male came to radiology department for X-ray chest with history of cough, mild fever and weight loss.

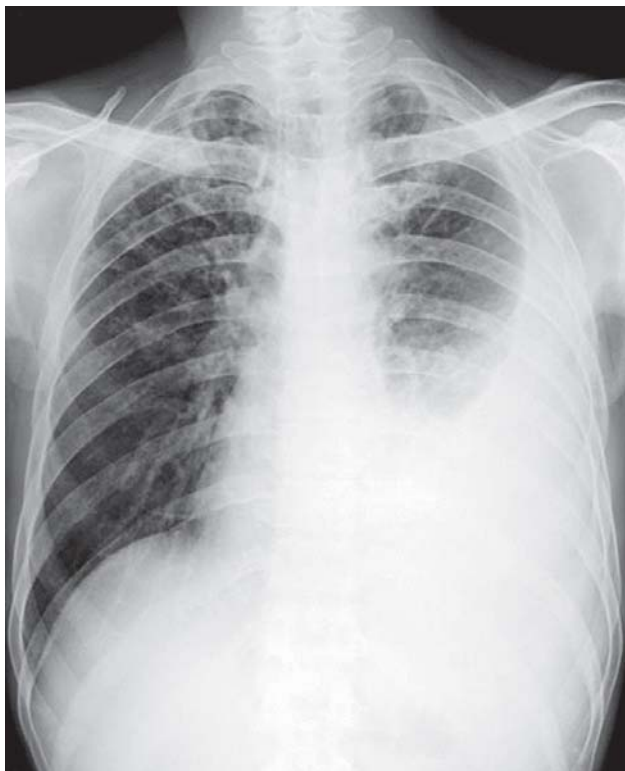


Fig. 4.7

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 4.7) shows fibro infiltrative lesions in right upper zone with areas of early calcification and moderate pleural effusion on left side with minimal tracheal pull to right side.

COMMENTS AND EXPLANATION

Pleural effusion is the accumulation of fluid in the pleural space, i.e. between the visceral and parietal layers of pleura. The fluid may be transude, exudate, blood, chyle or rarely bile.

Pleural fluid casts a shadow of the density of water on the chest radiograph. The most dependent recess of the pleura is the posterior costophrenic angle. A small effusion will, therefore, tend to collect posteriorly, however, a lateral decubitus view is the most sensitive film to detect small quantity of free pleural effusion (as small as 50 ml). 100–200 ml of pleural fluid is required to be seen above the dome of the diaphragm on frontal chest radiograph. As more fluid is accumulated, a homogeneous opacity spreads upwards, obscuring the lung base. Typically this opacity has a fairly well-defined, concave upper edge (Fig. 4.7), which is higher laterally and obscures the diaphragmatic shadow. Frequently the fluid will track into the pleural fissures. A massive effusion may cause complete radiopacity of a hemithorax. The underlying lung will retract towards its hilum, and the space occupying effect of the effusion will push the mediastinum towards the opposite side.

USG chest confirms the presence or absence of the pleural fluid; it also shows the septations within the pleural fluid with or without solid component within the lesion. USG helps in guiding aspiration of pleural fluid. CT scan is the most sensitive modality for detection of presence of minimal fluid. It allows distinction between free and loculated fluid showing its extent and localization.

OPINION

Pleuropulmonary tuberculosis.

CLINICAL DISCUSSION

Pleural effusion is either transudate or exudate. In transudate, the protein level is 1.5–2.5 g/dL and is seen in congestive heart failure, constrictive pericarditis, cirrhosis, nephrotic syndrome and hypothyroidism.

Exudate results from increased permeability of abnormal pleural capillaries with release of high-protein fluid into pleural space, protein level > 3 g/dL seen in empyema, tuberculosis and actinomycosis.

Tuberculous pleural effusions occur in up to 30% of patients with tuberculosis.

The current hypothesis for the pathogenesis of tuberculous pleural effusion is that a subpleural caseous focus in the lung ruptures into the pleural space 6–12 weeks after a primary infection. Mycobacterial antigens enter the pleural space and interact with T-cells previously sensitized to mycobacteria, resulting in a delayed hypersensitivity reaction and the accumulation of fluid. It seems that this reaction of the pleura augments the entry of fluid into the pleural space by increasing the permeability of pleural capillaries to serum proteins, and thereby increasing the oncotic pressure in the pleural fluid.

It appears that tuberculous pleurisy is due to a delayed hypersensitivity reaction rather than to a tuberculous infection.

Involvement of the lymphatic system probably also contributes to the accumulation of pleural fluid. An impaired clearance of protein from the pleural space has been reported in human tuberculous effusions. It is known that the clearance of proteins and fluid from the pleural space is carried out by lymphatics in the parietal pleura. Fluid gains access to the lymphatics through openings in the parietal pleura.

Case 20

A 43 years old male came to radiology department for X-ray chest with history of cough of few days duration.

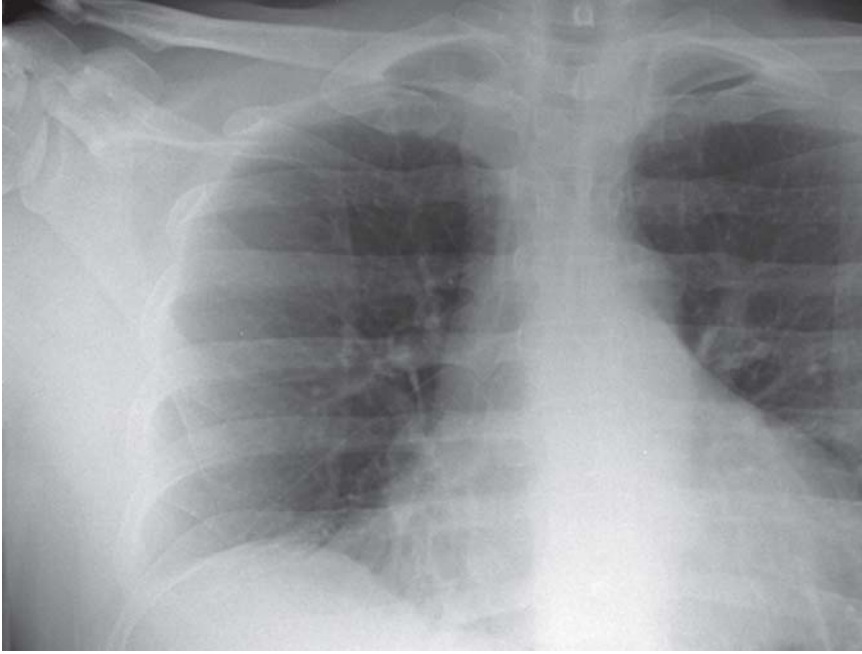


Fig. 4.8

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 4.8) shows normal lung parenchyma, a thin line is seen extending from the right diaphragm obliquely upward toward hilum, this is right inferior accessory fissure.

COMMENTS AND EXPLANATION

Magnified view (Fig. 4.9) shows the entire extent of inferior accessory fissure it is visualized as it runs in an AP plane similar to azygos fissure. It separates the medial basal segment of RLL from the remaining basal segments. It is of no clinical significance. Any segment of the lung can be separated from adjacent segment by an accessory fissure, and numerous accessory fissures have been identified, although they are of no clinical significance. Inferior accessory fissure commonly separates the medial basal segment of the right lower lobe of the lung from the other basal segments, occasionally seen as an oblique line near the right heart border on chest radiographs. It extends laterally and anteriorly from the hilum.

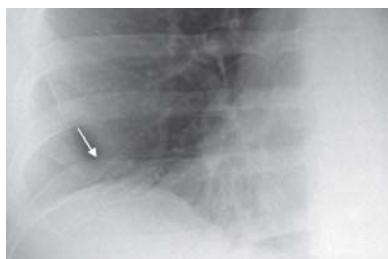


Fig. 4.9

OPINION

Right inferior accessory fissure.

CLINICAL DISCUSSION

On chest X-ray the oblique fissures on both sides run obliquely forwards and downwards with upper portion facing forward and laterally and the lower portion facing backward and medially, passing through the hilum. On a lateral view, the oblique fissures start at the level of 4th or 5th dorsal vertebra to reach the diaphragm 5 cm behind the costophrenic angle on the left and just behind the angle on the right side.

The right lung also has the minor fissure or horizontal fissure. On chest PA film it extends from right hilum to the sixth rib in axillary line. It separates the middle lobe from right upper lobe. There are some accessory fissures, which are occasionally seen.

The superior accessory fissure separates the apical from the basal segment of the lower lobes. The inferior accessory fissure separates the medial basal from the other basal segments.

Case 21

A 45 years male patient came to radiology department for X-ray chest with history of cough and expectoration of several months duration.



Fig. 4.10

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 4.10) shows a large plaque of calcification covering the lateral and anterior part of left lung. There is crowding of overlying ribs. Calcified pleural plaques have a characteristic rolled edge along its margin. Left upper lobe shows fibrotic lesions with bronchiectatic change and calcific spots are also seen.

COMMENTS AND EXPLANATION

Magnified view (Fig. 4.11) shows that pleural calcification plaques have a characteristic rolled edge along its margin. In general, pleural calcification is sequelae of hemothorax, empyema, tuberculosis or asbestos exposure. Hemothorax is usually confirmed by a history of significant chest trauma. There may be associated healed rib fractures. Although pulmonary contusion may have accompanied the acute episodes, contusion usually resolves without significant residual effect. Associated parenchymal scarring thus favors a diagnosis other than previous hemothorax.

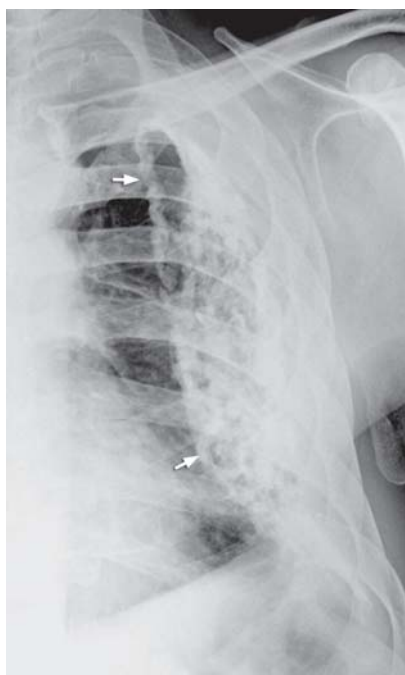


Fig. 4.11

OPINION

Pleural calcification.

CLINICAL DISCUSSION

Chronic empyema is a more common cause of pleural calcification. Recent CT studies indicate that chronic empyemas may calcify around their periphery while retaining collections of fluid for years. Occasionally, calcified pleural thickening from empyema does assume unusual or bizarre configurations and may be very extensive. It must be remembered that the interlobar fissures are part of the pleural space and may, therefore, be involved by an empyema.

In tuberculosis, pleural reaction is most commonly apical and asymmetric. Associated apical parenchymal scarring, cavities, or even multiple calcified granulomas are virtually diagnostic of tuberculosis. Asbestos exposure is a common cause of pleural calcifications measuring less than 3–4 cm. The pleural calcifications resulting from asbestos exposure most commonly affect the domes of the diaphragmatic pleura. They may be extensive and bilateral but are often asymmetric. HRCT has shown to be the most sensitive means for detecting minimal pleural changes from asbestos exposure. Pleural calcification is not seen in all cases of asbestos exposure, but can lead to one of the most specific appearances in chest radiology. Calcified pleural plaques seen en face has a characteristic rolled edge along their margins, denser than in the central portion of the plaque.

Case 22

A 24 years old male was brought to radiology department for X-ray chest following a road traffic accident.

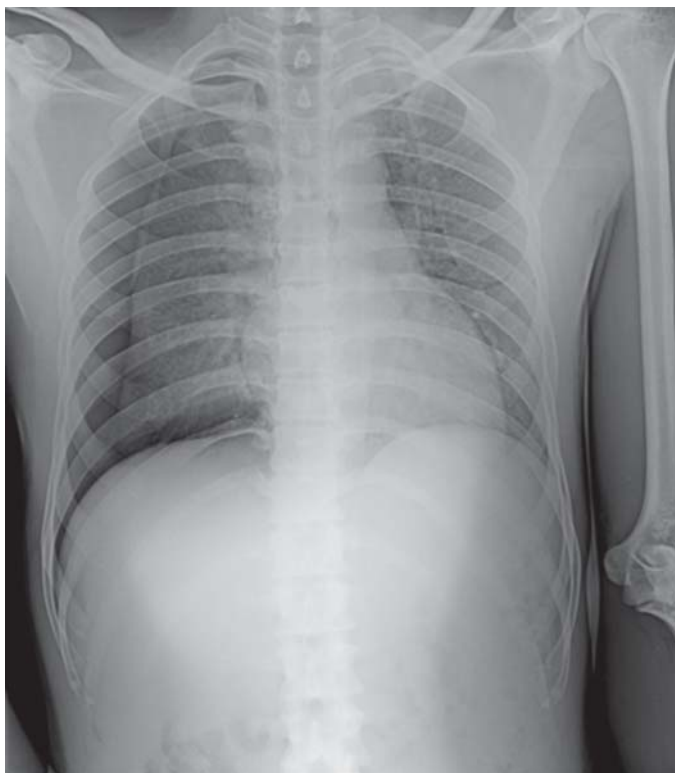


Fig. 4.12

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 4.12) shows presence of the air within the right pleural cavity with volume loss of right lung, as a result the right lung has partially collapsed. The outline of collapsed lung (Fig. 4.13) is seen well against the air.

COMMENTS AND EXPLANATION

Magnified view (Fig. 4.13) shows the outline of collapsed lung against the air (black arrow), on closer look there is very minimal surgical emphysema (white arrow) as the film was taken soon after the trauma and indicates that the air has entered into the pleural cavity through the defect in pleural layers following blunt or penetrating chest trauma. Ultrasound and CT may be helpful in detection of small pneumothorax.



Fig. 4.13

OPINION

Post-traumatic pneumothorax.

CLINICAL DISCUSSION

Presence of the air within the pleural cavity is termed as the pneumothorax. Air enters into the pleural cavity through the defect in pleural layers either spontaneously or due to trauma. Spontaneous pneumothorax when seen in healthy individuals without any precipitating event is known as primary spontaneous pneumothorax in contrast to the secondary spontaneous pneumothorax which is seen in the setting of a predisposing lung disease like chronic obstructive pulmonary disease (COPD). Traumatic pneumothorax is more common and is seen in patients undergoing

mechanical ventilation. Traumatic pneumothorax also occurs due to blunt or penetrating chest trauma.

Patient with pneumothorax present with acute onset of sharp chest pain, dyspnea and cough. On examination there is asymmetric lung expansion, reduced breath sounds on affected side and hyper-resonance on percussion.

Management varies from needle decompression to intercostal tube drainage and under water seal.

Lungs

Hariqbal Singh

Case 23

A newborn child was brought to radiology department for X-ray chest with breathing difficulty.

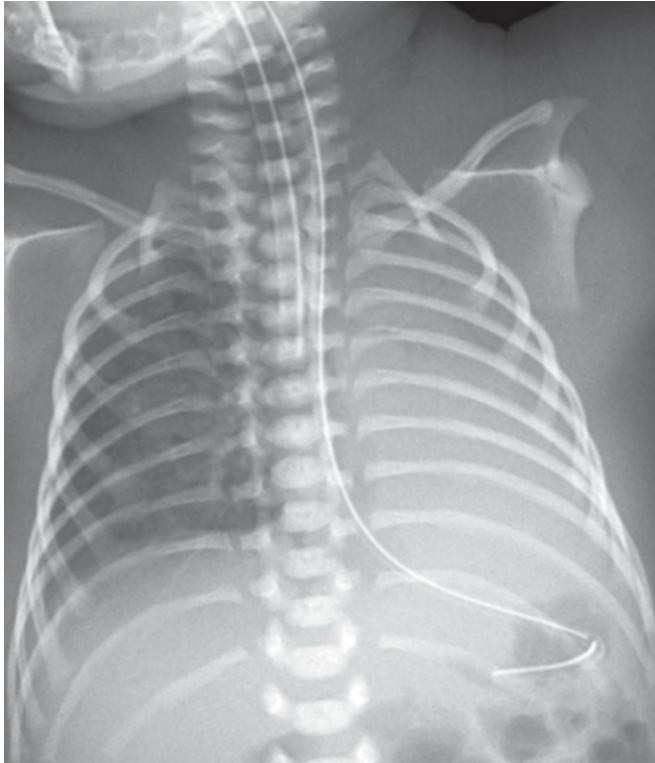


Fig. 5.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.1) shows opaque left hemithorax and the entire mediastinum is pulled to the left, the right lung has herniated beyond the midline. The endotracheal tube and Ryles tube are in situ. Diagnosis suggested is complete agenesis of left lung. This can be confirmed on CT chest.

COMMENTS AND EXPLANATION

The findings seen on chest film are absence of lung, opaque hemithorax, mediastinal shift with hernia of contralateral lung to the affected side with normal and symmetrical bony thorax.

CT chest can be helpful to differentiate the three categories of agenesis (a) complete agenesis, (b) lung aplasia and (c) lung hypoplasia.

Lung agenesis is rare, developmental anomaly of the lung. It can be:

1. Complete agenesis, manifested by total agenesis of lung tissue, bronchus and pulmonary vessels.
2. Lung aplasia manifested by a rudimentary bronchus but absent lung tissue and pulmonary vessels.
3. Lung hypoplasia manifested by rudimentary bronchus with hypoplastic lung tissue and pulmonary vessels.

OPINION

Agenesis of left lung.

CLINICAL DISCUSSION

There may be complete absence of a whole lung and its bronchus. In lung aplasia there is no lung tissue but a blind main bronchus is present. Both anomalies show opaque hemithorax with displacement of the mediastinal structures, diaphragm and contralateral lung. Agenesis of both lungs is incompatible with life. Unilateral pulmonary agenesis is associated with a high incidence of congenital anomalies in other organs particularly the cardiovascular system, alimentary tract with anal and esophageal atresia, tracheo-esophageal fistula and renal agenesis. It can be easily ruled out when performing an ultrasonography.

Case 24

A 45 years old patient came to radiology department for X-ray chest with history of cough and expectoration of several months duration.



Fig. 5.2

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.2) shows that the lungs are large in volume with streaky shadows and multiple cystic lesions with air fluid levels. These cystic lesions can also be seen through the heart shadow. This is bronchiectasis.

COMMENTS AND EXPLANATION

Bronchiectasis is localized, irreversible dilation of part of the bronchial tree as a result of destruction of the muscle and elastic tissue of bronchial wall. Involved bronchi are dilated, inflamed, and collapsible. They result in airflow obstruction and lead to impaired clearance of secretions which on X-ray is seen as air fluid levels (Fig. 5.3).

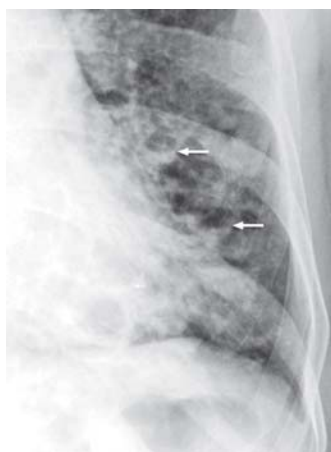


Fig. 5.3

OPINION

Bronchiectasis.

CLINICAL DISCUSSION

Bronchiectasis results from necrotizing bacterial infections, caused by the *Staphylococcus* or *Klebsiella* species or *Bordetella pertussis*.

The diagnosis of bronchiectasis is based on the review of clinical history, X-ray chest and CT scan show characteristic patterns. Bronchiectasis is often caused by recurrent inflammation or infection of the airways. Most often it begins in childhood as a complication from infection.

Tuberculosis is the leading cause of bronchiectasis. Endobronchial tuberculosis commonly leads to bronchiectasis, from bronchial stenosis or fibrosis. Acquired Immune Deficiency Syndrome (AIDS) is another major cause especially in children.

Case 25

A 12 years old male was brought to radiology department for X-ray chest with history of pain abdomen and fever for 20 days and was diagnosed as a case of hepatoblastoma.

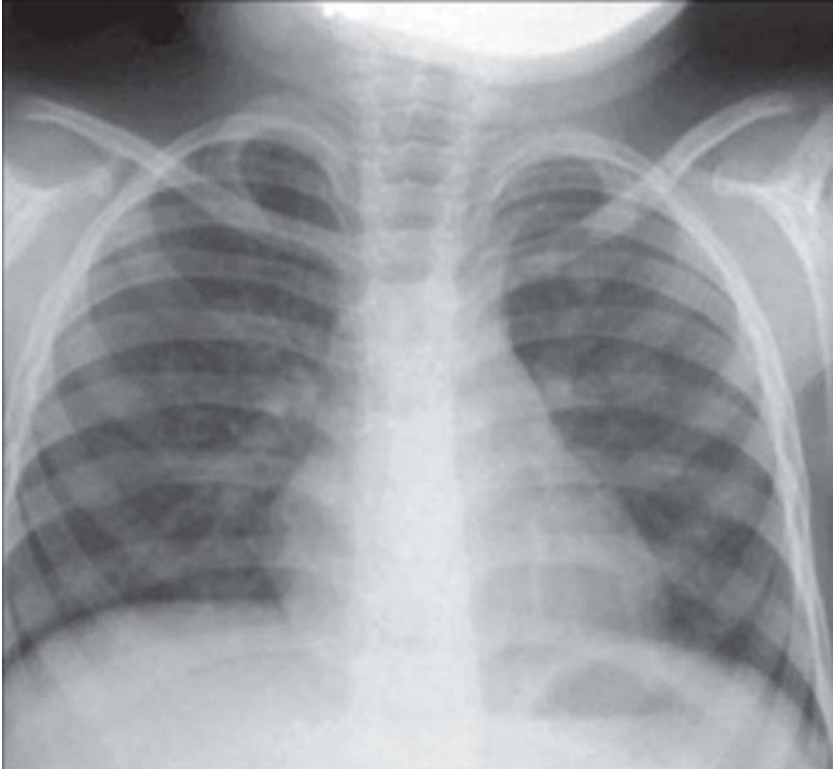


Fig. 5.4

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On X-ray chest (Fig. 5.4) lung fields give a suspicion of multiple small rounded lesions, with history of hepatoblastoma. CT chest was advised to confirm metastasis.

COMMENTS AND EXPLANATION

CT scan of the chest (Fig. 5.5) shows multiple, small, peripheral metastatic lesions.

Hepatoblastoma is the most common primary liver tumor in children, accounting for 79% of pediatric liver malignancies in children younger than 15 years.

Pulmonary metastases are not visible in conventional X-rays unless they are larger than 6 mm in diameter. Peripheral metastases are also not visible on X-ray chest.

On CT images, however, they can be detected at about 3 mm in diameter. If metastases are located in the periphery, it is easy to differentiate them from blood vessels cut in cross-section. Small metastases located close to the hilum are much more difficult to distinguish from vessels.

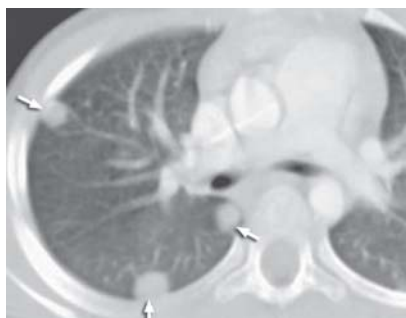


Fig. 5.5

Lung windows should always be used for examining lung parenchyma. In the case of multiple small metastases close to the pleura can be overlooked if lung windows are not used. These examples demonstrate the importance of viewing each image on lung and soft-tissue windows and in different window width and window center.

When multiple lung metastases are present they can be recognized in the topogram. Depending upon the age and vascularization of the metastases, they appear as spherical nodules of varying sizes or may have irregular contours (stellate or speculated). If, however, they are solitary and have central calcification (like a popcorn), or peripheral calcification, the lesions are most likely to be a benign hamartoma or granuloma.

OPINION

Pulmonary metastasis.

CLINICAL DISCUSSION

Spread of metastatic disease to the lungs can occur in different ways, i.e. hematogenous through pulmonary or bronchial arteries, lymphatic or via airways. 80 to 90 percent cases of pulmonary metastases show symptoms and signs of primary malignancy elsewhere. Pulmonary metastases occur from malignancy in the breast, gastrointestinal tract, kidney, testes, head and neck, or bone and soft tissue.

Recognizable patterns of pulmonary metastases are parenchymal nodule, lymphatic and interstitial spread, tumor emboli, endobronchial tumor and pleural effusion.

Case 26

A 43 years old male came to radiology department for X-ray chest with history of cough, fever and weight loss with loss of appetite since two months.

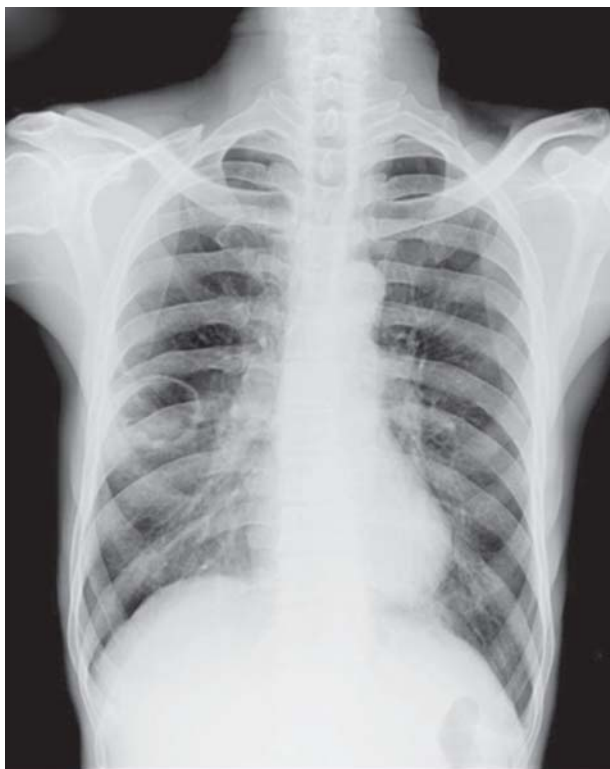


Fig. 5.6

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.6) shows a right mid zone cavity with thick irregular wall with non-homogeneous shadowing due to an irregular spongework filling the cavity with intervening air spaces.

COMMENTS AND EXPLANATION

Superinfection with *Aspergillus* generally occurs in a pre-existing cavity (tuberculous or bronchiectasis) in immune-compromised patient.

Initially, the aspergilloma appears as an irregular spongework filling the cavity with intervening air spaces (Fig. 5.7). Presumably this appearance reflects the presence of irregular flocks of fungal mycelia mixed with residual intracavity air. Furthermore, thickening of the wall of the cavity can be a finding of superimposed fungal infection well prior to development of a fungal ball as has been demonstrated in this case.



Fig. 5.7

OPINION

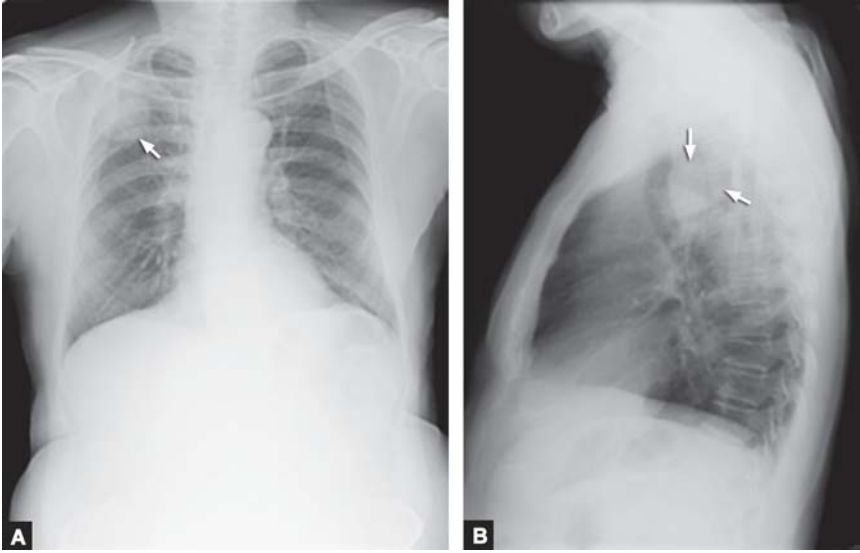
Developing aspergilloma.

CLINICAL DISCUSSION

A fungus ball or mycetoma caused by one of the *Aspergillus* species which infect humans. Among the common varieties are *A. fumigatus* and *A. niger*. Aspergillomas are collections of fungal hyphae and cellular debris which occur inside a pre-existing cavity as a saprophytic growth. Initially mycetomas may produce wall thickening of the cavity wall. Fungal growth finally results in a free-moving rounded mass which usually does not fill the cavity completely. Aspergillomas are typically detected on chest radiographs as an incidental finding or are discovered as a cause of hemoptysis. If the mass begins to fill the entire cavity an air crescent sign may be seen on chest films. Calcification and fluid levels are rare.

Case 27

A 70 years old male patient came to radiology department for X-ray chest with history of cough and general weakness.



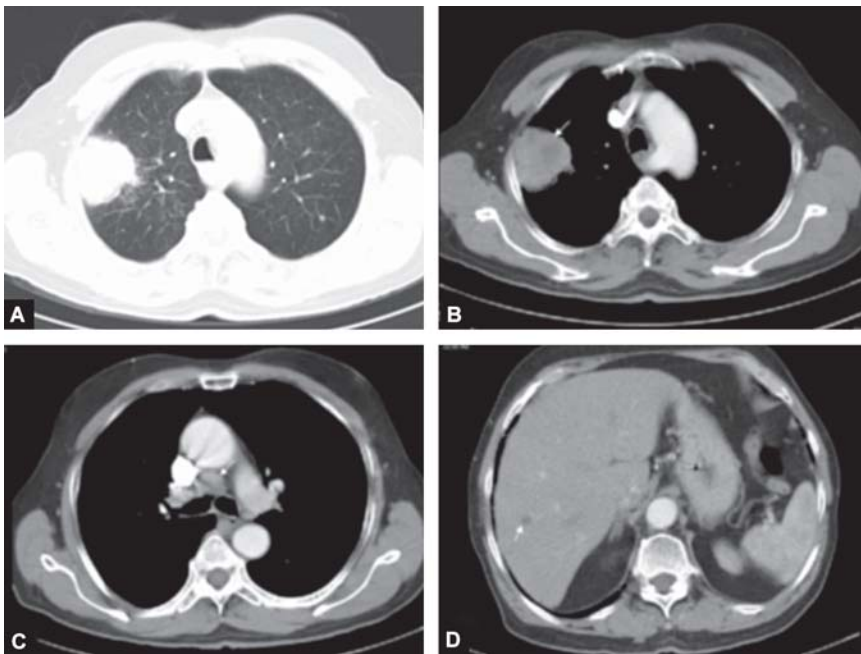
Figs 5.8A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Figs 5.8A and B) shows a mass lesion in right upper lobe (arrow), likely bronchogenic carcinoma.

COMMENTS AND EXPLANATION

To confirm the diagnosis, CT chest was performed. CT chest (Figs 5.9A and B) shows ill-defined rounded opacity abutting the chest wall with radiating strand seen in right upper lobe with minimal necrosis within, seen in mediastinal window. Mediastinal window (Fig. 5.9C) shows aortopulmonary lymph node (arrow). A small round hypodense metastases is seen in the right lobe of liver (Fig. 5.9D).



Figs 5.9A to D

OPINION

Bronchogenic carcinoma.

CLINICAL DISCUSSION

Commonest fatal malignancy in the adult males is carcinoma of the bronchus. Carcinoma bronchus is of four types: squamous cell carcinoma, adenocarcinoma, small cell carcinoma and large cell carcinoma.

Lung tumors are classified as—

A. Primary

- Benign
- Malignant

B. Metastases

On X-ray chest, it presents as central or peripherally situated mass. Features suggesting malignancy are nodular mass with irregular, spiculated margins; cavitating mass lesion with thick irregular or nodular walls. It may be associated with hilar enlargement or segmental or lobar collapse of the lung. Central bronchogenic carcinoma causes collapse of distal lobe resulting in the traditional Golden S sign; however, a more appropriate would be inverted pyramid sign. CT is indicated for the staging of carcinoma lung and detecting metastasis.

Lung is the most common site for metastatic disease. Most common primaries are breast, gastrointestinal tract, kidney, testes, head and neck, and bones. On imaging, it shows various patterns like multiple parenchymal nodules, lymphangitis carcinomatosa or pleural effusion.

Case 28

A 2 years old child was brought to radiology department for X-ray chest with cough and high fever over last 3 days.



Fig. 5.10

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.10) shows soft small ill-defined opacities scattered in both lung fields partially sparing the lower zones.

COMMENTS AND EXPLANATION

On X-ray bronchopneumonia appears as small fluffy ill-defined acinar nodules, which coalesce and enlarge with time and may develop into segmental and lobar densities with volume loss from airway obstruction secondary to mucus plugging and bronchial narrowing.

OPINION

Bronchopneumonia.

CLINICAL DISCUSSION

Bronchopneumonia is a combination of interstitial and alveolar disease. In bronchopneumonia the insult begins in airways, involves bronchovascular bundle and trickles into alveoli, which may develop and contain edema fluid, blood, leukocytes, hyaline membranes and organisms.

The organisms which lead to bronchopneumonia are (a) *Staphylococcus aureus* (b) *Pseudomonas pneumonia* (c) *Streptococcus* (d) *Klebsiella* and (e) *Mycoplasma*.

Antibiotic therapy is the mainstay of treatment of bacterial pneumonia. However, patients who have bronchospasm with infection benefit from inhaled bronchodilators, administered by means of a nebulizer metered-dose inhaler. Hospitalized patient should be initially placed on broad-spectrum antibiotic and cover the likely causative organisms. Definitive therapy should be based on laboratory data, susceptibility patterns and clinical response. Direct admission to an intensive care unit (ICU) is mandatory for any patient in septic shock with a requirement for vasopressors or with acute respiratory failure requiring intubation and mechanical ventilation.

Case 29

A 60 years old male came to radiology department for X-ray chest with history of cough.



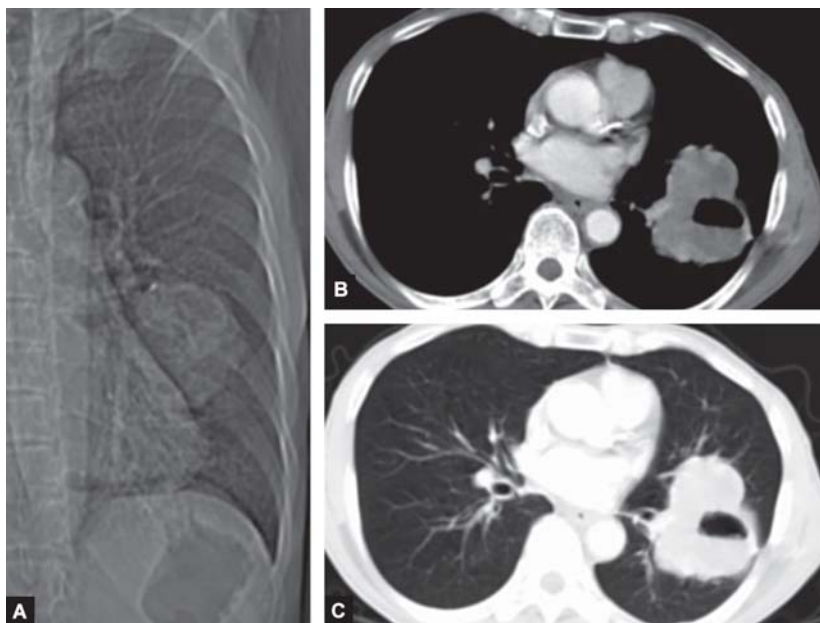
Fig. 5.11

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.11) shows a mass lesion measuring 6 cm in diameter in left lower zone of which the margins are not smooth, finding suggestive of carcinoma lung, however, needs confirmation on CT chest.

COMMENTS AND EXPLANATION

The patient was subjected to CT chest (Figs 5.12A to C) shows moderately enhancing irregular mass lesion measuring 5 × 6 cm in the superior segment of LLL and lingula. Feeding vessel is also seen. Multiple areas of necrosis are seen within. There is central cavitation and air fluid level. Surrounding lung shows infiltration. Multiple pretracheal, carinal, and subcarinal lymph nodes are seen measuring 11–17 mm. Diagnosis of carcinoma lung was made. Mass lesion seen in the lung after the age of 40 years (age of this patient is 60 years) should be considered malignant unless proved otherwise.



Figs 5.12A to C

OPINION

Carcinoma lung.

CLINICAL DISCUSSION

Carcinoma lung is the most common fatal malignant neoplasm in men and it has now surpassed breast cancer as the leading cause of cancer

death in women. Most lung cancer deaths are directly attributable to cigarette smoking. The risk of lung cancer occurrence is related to the number of cigarettes smoked, the number of smoking years, the age at which smoking began, and the depth of inhalation. The risk decreases with cessation of smoking but never completely disappears. Other etiological factors including genetic and occupational factors and the presence of concomitant disease in the lung may play a role in the development of lung cancer.

Patients with central tumors obstructing a major bronchus may present with cough, wheezing, hemoptysis and lung infection. Local intrathoracic spread may result in left laryngeal nerve paralysis, pleural or chest wall pain, symptoms related to superior vena cava obstruction or Pancoast neoplasm. Histologically, the common cell types of lung cancers include adenocarcinoma, squamous cell carcinoma, small cell carcinoma and large cell undifferentiated carcinoma.

The radiological appearance depends on intrathoracic spread including bone destruction, pleural effusion, hilar and mediastinal lymphadenopathy, lung nodule in the contralateral lung, mediastinal mass, pleural nodularity or nodular thickening of the interlobular septa.

Case 30

A 33 years old male patient came to radiology department for X-ray chest with history of cough, fever with shivering and night sweats since seven days.

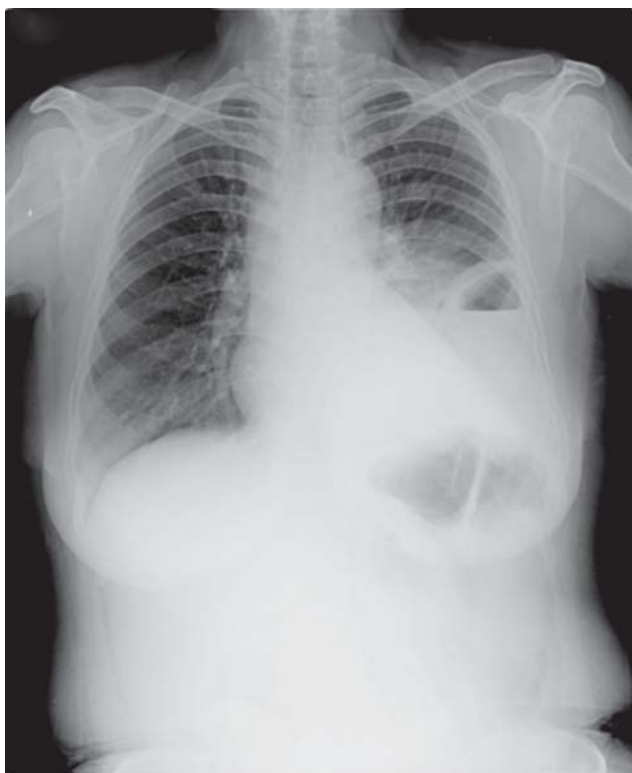


Fig. 5.13

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.13) shows a thick walled abscess cavity with air fluid level in left lower lobe.

COMMENTS AND EXPLANATION

Lung abscess is necrosis of the pulmonary tissue and formation of cavities of more than 2 cm in diameter containing fluid caused by microbial infection or necrotic debris.

This pus-filled cavity is often due to aspiration, which may occur during altered consciousness. Alcoholism is the most common condition predisposing to lung abscesses.

OPINION

Lung abscess.

CLINICAL DISCUSSION

Lung abscess is primary when it results from pre-existing lung parenchymal process and is secondary when it complicates another process like vascular emboli or follows rupture of extrapulmonary abscess into lung.

Conditions contributing to lung abscess are (a) aspiration of oropharyngeal or gastric secretion (b) septic emboli (c) necrotizing pneumonia and (d) vasculitis: Wegener's granulomatosis.

Most lung abscesses respond to antibiotics unless there is a debilitating underlying condition.

Onset of symptoms is often gradual, but in necrotizing staphylococcal or Gram-negative bacillary pneumonias patients can be acutely ill. Cough, fever with shivering and night sweats are often present.

Abscess is often unilateral and single more frequently involving posterior segments of the upper lobes and the apical segments of the lower lobes being gravity dependent when lying down. Presence of air-fluid levels implies rupture into the bronchial tree or rarely growth of gas forming organism.

Case 31

A one day old newborn child was brought to radiology department for X-ray chest with breathing difficulty.



Fig. 5.14

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.14) shows right upper lobe consolidation and rest of the lungs show patchy to streaky areas suggesting meconium aspiration syndrome.

COMMENTS AND EXPLANATION

In meconium aspiration syndrome (MAS) the newborn breathes a mixture of meconium and amniotic fluid into the lungs around the time of delivery.

Meconium is the early feces passed by a newborn soon after birth, in some cases; the baby passes meconium while still inside the uterus. This usually happens due to lack of enough blood and oxygen.

Once the meconium has passed into the amniotic fluid, the baby may breathe meconium into the lungs. This condition is called MAS. It causes breathing difficulty due to inflammation in the lungs after birth.

Meconium aspiration syndrome is a leading cause of severe illness and death in newborns. However, in most cases, the outlook is excellent and there are no long-term health effects provided the infant is placed in newborn intensive care unit for close observation and treatment.

OPINION

Meconium aspiration syndrome.

CLINICAL DISCUSSION

Infants who suffer hypoxic stress in utero may pass meconium, from their gastrointestinal tract, into the amniotic fluid which is then inhaled. Meconium consists of hyperosmolar, viscid intestinal secretions. Aspiration of small amounts may be harmless; inhalation of large amounts results in widespread patchy collapse and consolidation combined with a severe inflammatory reaction. The viscous inhaled meconium may cause complete bronchial obstruction or partial occlusion with a 'ball valve' effect that may lead to areas of hyperinflation in the peripheral lung. The chest radiograph shows patchy areas of collapse and consolidation with areas of hyperinflation or in severe cases almost a white out due to alveolar consolidation. Pneumothorax and pneumomediastinum are frequent complications which can result in hypoxia and lead to pulmonary artery vasoconstriction, pulmonary hypertension and right-to-left shunting across the ductus arteriosus. The treatment is immediate removal of the meconium by suction of the airways via an endotracheal tube at the time of delivery. If this is not possible management is often difficult and recovery is often slow. Occasionally, treatment with extracorporeal membrane oxygenation is required.

Case 32

A 25 years old farmer came to radiology department for X-ray chest with history of asthma and eosinophilia.

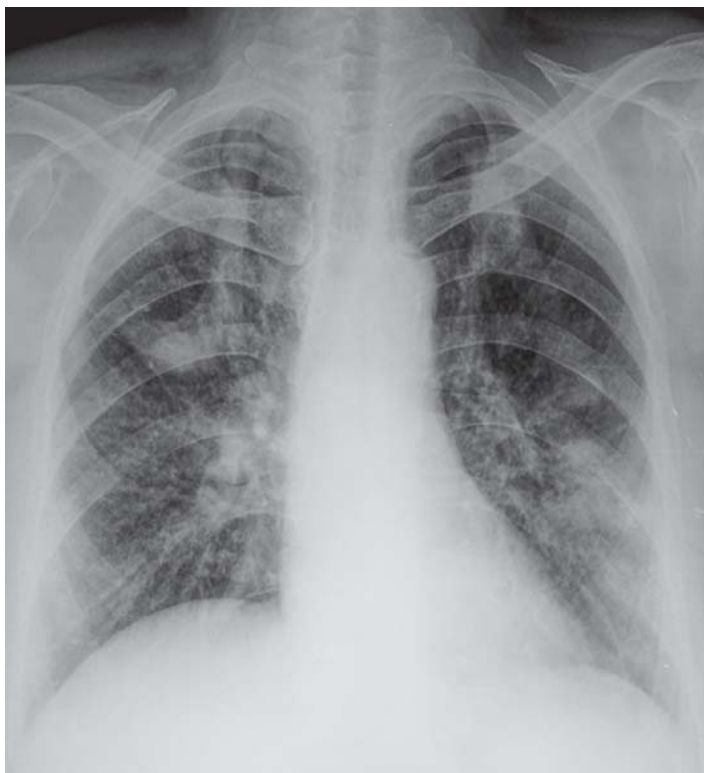


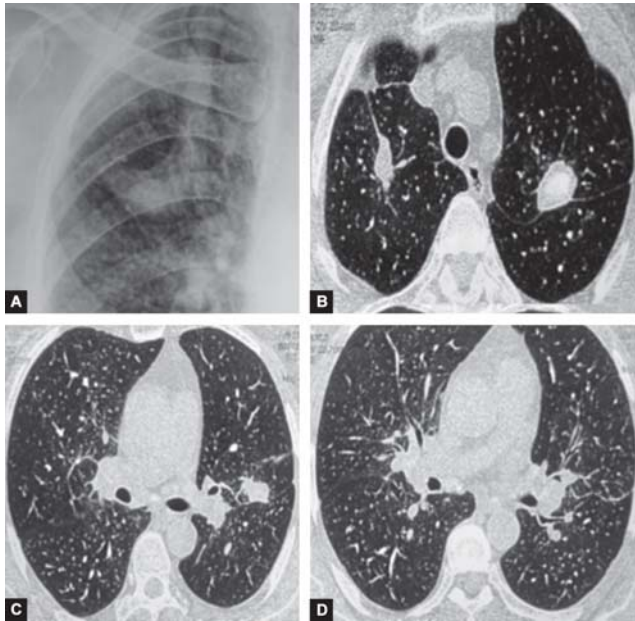
Fig. 5.15

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.15) shows gloved finger opacities and nodular infiltrates in both lung fields.

COMMENTS AND EXPLANATION

To confirm the chest X-ray finding, CT chest (Figs 5.16A to D) was performed which on lung window showed mucoid impaction in the dilated bronchioles and air trapping. This type of lung infiltrates are finger-in-glove appearance of bronchioles is diagnostic of allergic bronchopulmonary aspergillosis.



Figs 5.16A to D

OPINION

Allergic bronchopulmonary aspergillosis.

CLINICAL DISCUSSION

Allergic bronchopulmonary aspergillosis (ABPA) is seen in patients with asthma and cystic fibrosis as a result of chronic colonization of the airways by *Aspergillus fumigatus*. Clinically, the features are recurrent episodes of wheezing, mucus production, pulmonary infiltrates, and elevated levels of serum IgE. Many patients develop central bronchiectasis, and a few progress to end-stage fibrotic lung disease. The treatment is essentially oral corticosteroids.

Case 33

A 39 years old female came to radiology department for X-ray chest with history of dyspnea on exertion.



Fig. 5.17

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.17) shows that the lung fields are diffusely occupied by discrete high density opacities resembling grains of sands. In spite of superimposition or summations of shadows the individual deposits are identifiable and measure about a 1 mm in diameter thick and streaky. The opacity appears confluent showing the lungs as almost white with obliteration of the mediastinal and diaphragmatic contours and pulmonary vascular marking are indistinct. The density is greater over the lower than the upper zone.

COMMENTS AND EXPLANATION

The characteristic finding on the chest radiograph is that of a fine, dense stippling. This is a well-defined, nodular infiltrate which involves both lungs, and may be so extensive as to cause opaque lungs with relative lucency of the mediastinal structures, diaphragm and pleura. There is widespread parenchymal calcification.

In addition to the finding seen, other findings that may be seen include bullae in the lung apices, a zone of increased lucency between lung parenchyma and the ribs (a black pleural line) and pleural calcification. In some patients concentration of the nodules in subpleural, para septal and peribronchiolar alveoli can produce linear strands of calcification parallel to or perpendicular to the pleural surface.

OPINION

Pulmonary alveolar microlithiasis.

CLINICAL DISCUSSION

The cause of pulmonary alveolar microlithiasis is unknown, and majorities are diagnosed between the ages of 30–50 years. There is no sex predominance. The disease exhibits a strong familial tendency. Most patients are asymptomatic. When the patient is symptomatic, most common symptom is dyspnea on exertion. Non productive cough and hemoptysis develops in some patients. There are often no physical signs in the chest even when the radiography is grossly abnormal, later there may be inspiratory crepitation and ultimately the signs of cor-pulmonale.

Biopsy shows calcified spherules filling alveolar spaces. The spherules have a concentric lamelleted appearance suggesting that they grow by the addition of successive layers. The spherules contain both calcium and phosphorus. Deposits of calcium phosphate measuring 0.1 to 0.3 mm in size are found in the alveoli. It is a chronic disease without evidence of clinical abnormality until an advanced stage, when right heart failure may result from pulmonary fibrosis.

Case 34

A 48 years old patient who was a known case of choriocarcinoma came to radiology department for X-ray chest.

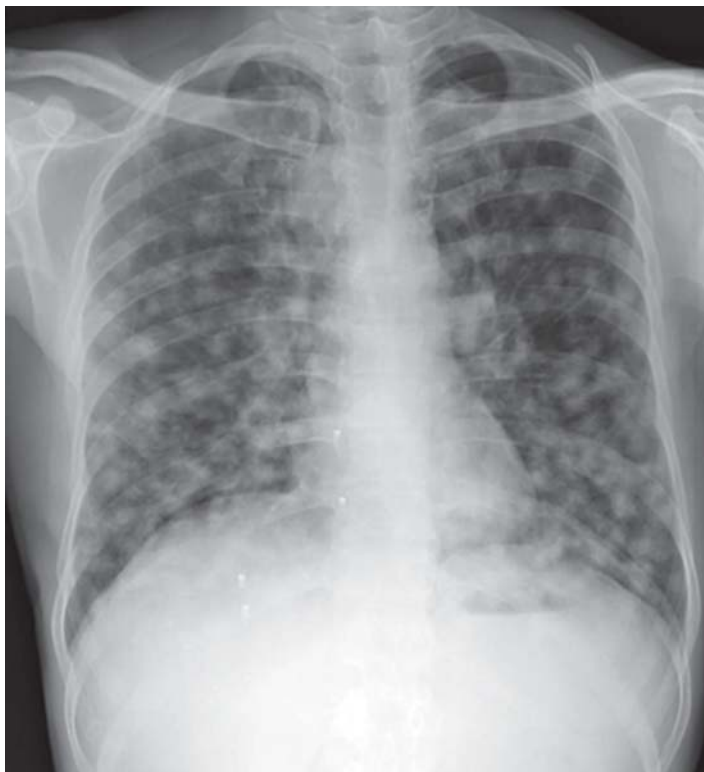


Fig. 5.18

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.18) shows multiple similar sizes infiltrates of various shapes scattered over both lung fields, they are ill-defined in outline.

COMMENTS AND EXPLANATION

Chest X-ray is usually the first examination performed to detect pulmonary metastases. Choriocarcinoma is trophoblastic and aggressive malignancy of placenta. It is characterized by early hematogenous spread to the lungs. Frequency of pulmonary metastasis in choriocarcinoma at presentation is 60% and at autopsy is 70–100%. Chest X-ray shows multiple infiltrates of various shapes in both lungs. Choriocarcinoma is one of the tumors that is most sensitive to chemotherapy.

OPINION

Pulmonary metastases from choriocarcinoma

CLINICAL DISCUSSION

The incidence of pulmonary metastases varies with the primary tumor and the stage of the disease. Pulmonary metastases most frequently occur with tumors that have rich systemic venous drainage. The most common sources of pulmonary metastases include tumors of the breast, colon, kidney, uterus, prostate, head and neck. Tumors such as choriocarcinoma, osteosarcoma, Ewing's sarcoma, testicular tumors, melanoma and thyroid carcinoma also have a high incidence of pulmonary metastases.

Pulmonary metastases may result from spread by direct extension or seeding of body cavities such as the pleura. However, true metastases to the lung occur by hematogenous, lymphatic and endobronchial routes. Hematogenous spread is the most common pathway. The hallmark of hematogenous pulmonary metastases is one or more pulmonary nodules predominantly distributed in the periphery of the lungs, most lying in close proximity to the pleura. Occasionally, they show very irregular margins usually attributable to hemorrhage around the periphery of the metastatic nodules. CT is the most sensitive imaging technique available for the detection of pulmonary metastases. However, CT findings are nonspecific. Granuloma and subpleural pulmonary lymph nodes can be indistinguishable from metastases.

After chemotherapy, many metastases decrease in size or completely resolve. However, some metastases after initial response to therapy become stable in size. Such nodules may only contain necrotic or fibrous tissue and no viable tumor.

Case 35

A 38 years old female came to radiology department for X-ray chest with history of breathlessness and dry cough and gradually increasing dyspnea on exertion since 8 months.

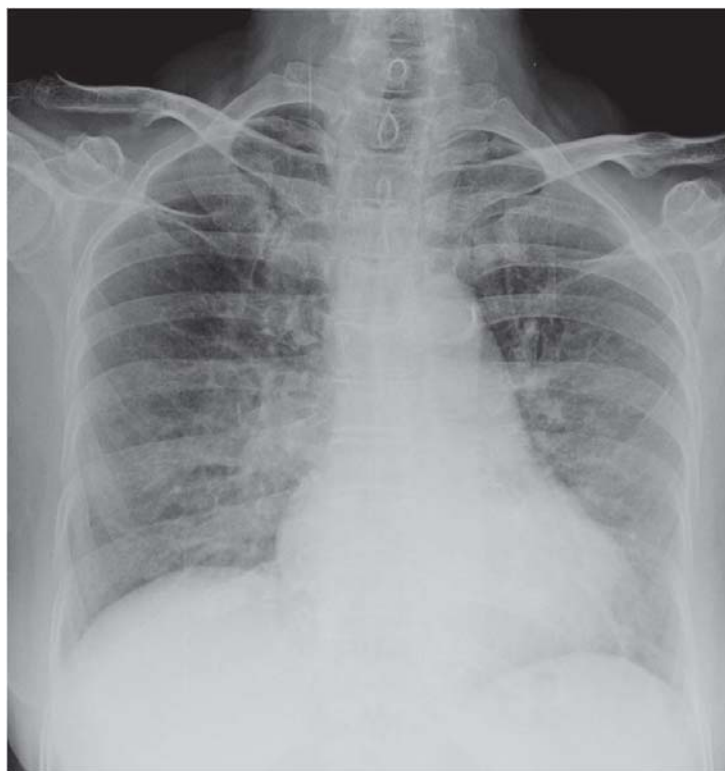


Fig. 5.19

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On chest X-ray (Fig. 5.19) the lungs show increased whiteness with increased streakiness more prominent in the bases, X-ray chest finding with clinical data suggests possibility of idiopathic pulmonary fibrosis. High resolution CT (HRCT) was advised.

COMMENTS AND EXPLANATION

HRCT chest (Fig. 5.20) shows diffuse areas of ground glass appearance scattered in the aerated lungs. In these cases subsequent to development of scattered ground glass appearance subpleural areas of honeycombing develop gradually reducing the vital capacity of the lungs.

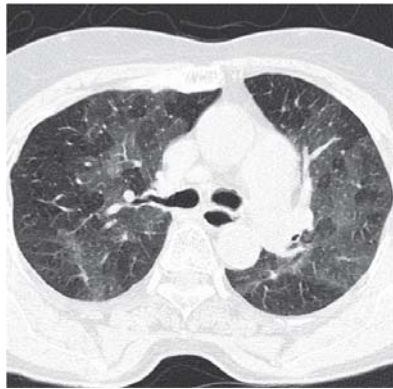


Fig. 5.20

OPINION

Idiopathic pulmonary fibrosis.

CLINICAL DISCUSSION

Idiopathic pulmonary fibrosis (IPF) is chronic, progressive interstitial lung disease. It is a chronic fibrosing interstitial pneumonia characterized with abnormal and excessive deposition of fibrotic tissue with minimal associated inflammation. Initially, the chest X-ray is normal in about 20% patients at the time they're diagnosed. In predominantly interstitial diseases, alveolar air is essentially preserved and it is the tissues surrounding the air spaces that are increased in volume.

Case 36

An 18 years old boy came to radiology department for X-ray chest with history of fever for two weeks.

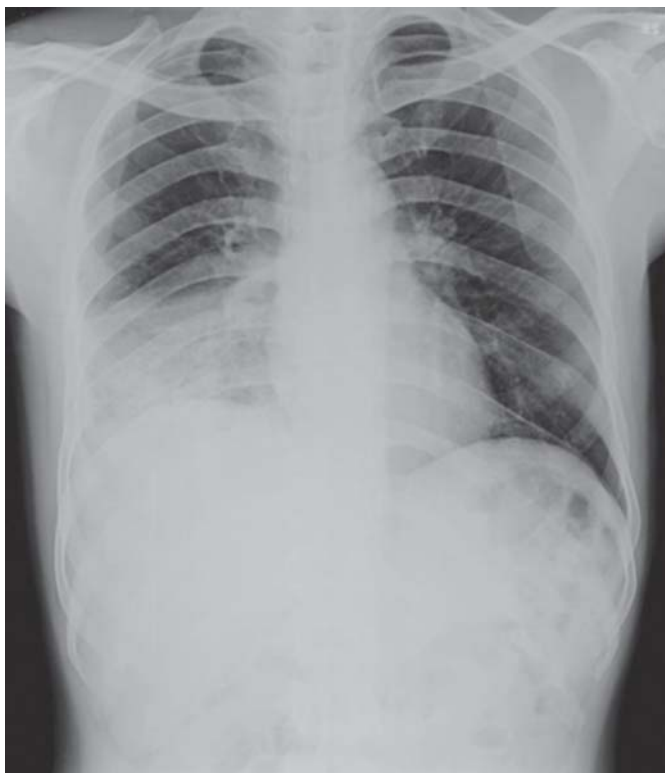


Fig. 5.21

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.21) shows increased lung density in right lower lobe. There is no loss of clarity of the right heart border. There is some loss of definition (silhouette sign) of the lateral aspect of the right hemidiaphragm suggesting that the opacity is within the right lower lobe. Blunting of the right costophrenic angle is seen.

COMMENTS AND EXPLANATION

The right lower lobe is comprised five pulmonary segments. It is a large lobe and provides varying patterns of consolidation depending on the segments. Consolidation refers to fluid in the airspaces of the lung. Right lower lobe is a relatively common site for consolidation and can be, at times, missed if a lateral view is not included in the series. It is considered that the loss of visualization the right hemidiaphragm is a sign of RLL disease. Consolidation may be complete or incomplete.

The lateral view shows increased density behind the heart shadow. This is consolidation within the right lower lobe. One of the useful clues when looking for consolidation on a lateral view is loss of the normal darkening inferiorly of the thoracic vertebral bodies on the lateral view. RLL consolidation is limited superiorly by oblique fissure.

OPINION

Right lower lobe consolidation.

CLINICAL DISCUSSION

Bacteria account for the significant majority of lung infections. Specific bacterial organisms may be implicated depending upon the background in which pneumonia occurs. For example, typical community-acquired disease is generally a result of infection with *Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Legionella pneumophila*, *Haemophilus influenzae*, or *Chlamydia pneumoniae*. Hospital-acquired infections are generally caused by Gram-negative organisms such as *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Staphylococcus aureus*.

Most typically community-acquired bacterial pneumonia produces a lobar homogeneous opacity in the lung periphery. More than one lobe may be involved. The inflammatory response to these bacteria produces dense consolidation because there is significant inflammatory fluid production which spreads rapidly through the pores of Kohn and the canals of Lambert into adjacent alveoli. The progress of this consolidation if unimpeded leads to lobar pneumonia. Some organisms, for instance anaerobes, have a tendency to occur in dependent portions of lung.

If untreated, acute bacterial pneumonias may spread throughout the lungs, subsequently resulting in systemic dissemination and death. If appropriately treated, most bacterial pneumonias resolve quickly and signs of radiographic improvement should be evident within days with near or complete resolution expected within 2–3 weeks.

Case 37

A 17 years old female came to radiology department for X-ray chest with history of cough, expectoration, fever and anorexia of 3 months duration.



Fig. 5.22

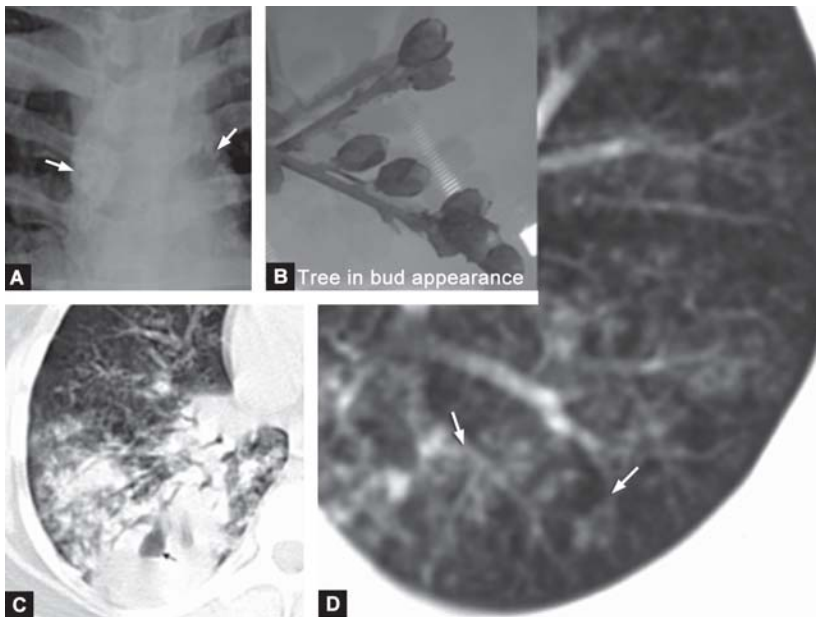
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.22) shows non-homogeneous shadowing in right base with air bronchogram suggesting consolidation. Just above the area of consolidation in RLZ, show small scattered nodular lesions. Some nodular scattered infiltrates are also seen in both apices and LLZ. Bilateral calcified tracheobronchial lymph nodes are seen (Just above the left clavicle is seen a rounded opaque shadow due to a knot tied from plait of hairs). Findings suggest tuberculosis etiology caused by reactivation of infection implanted during primary tuberculosis or from tracheobronchial lymph nodes resulting in consolidation with endobronchial tuberculosis.

COMMENTS AND EXPLANATION

Enlarged view (Fig. 5.23A) shows bilateral calcified tracheobronchial lymph nodes.

Patient was subjected to HRCT chest which revealed multiple confluent centrilobular nodules seen in both lung fields predominantly at both bases (R > L) giving a tree in bud appearance is seen at many places (Figs 5.23B and D). The nodules are confluent at right base to form areas of consolidation (Fig. 5.23C) with cavitation (black arrow). Multiple calcified foci are seen in the mediastinum suggestive of calcified nodes. Calcified nodes are also noted in bilateral supraclavicular region. Large left axillary lymph nodes measuring 2 cm in diameter were also seen in the scan.



Figs 5.23A to D

OPINION

Endobronchial tuberculosis with consolidation and cavitation.

CLINICAL DISCUSSION

Mycobacterium tuberculosis bacilli are carried via aerosolized droplet nuclei into the alveoli. An exudative response occurs within the air spaces. The bacteria are phagocytized but not killed by polymorphonuclear leukocytes and macrophages and continue to multiply intracellularly. During the 2–6 weeks following infection, organisms proliferate, spread to lymph nodes and then systemically. The radiographic changes of pulmonary tuberculosis are generally considered in two forms: primary or postprimary.

Tree-in-bud sign represents bronchiolar dilatation and filling by mucus, pus or fluid, resembling a branching tree with buds at the tips of the branches. Usually visible in the lung periphery, this finding is indicative of airway disease, and is particularly common in endobronchial spread of tuberculosis, cystic fibrosis, diffuse panbronchiolitis, and other causes of chronic airway infection.

Case 38

A 27 years old male came to radiology department for X-ray chest with history of persistent cough with expectoration over several weeks.



Fig. 5.24

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.24) shows nonhomogeneous fibro patchy nodular lesions involving the entire right upper lobe with volume loss with resultant pulling up of right hilum. These are features of active lesion.

COMMENTS AND EXPLANATION

Another case (Fig. 5.25) shows multiple calcified lesions are seen in both lungs essentially in the upper lobes. Marked fibrosis in left upper zone as a result mediastinum is pulled to the left and left hilum is pulled up. There is also fibrosis in right upper zone with the right hilum pulled up.

Radiographic findings in pulmonary tuberculosis are divided into two forms. Primary tuberculosis represents the initial infection with *Mycobacterium* bacilli in an unsensitized host.

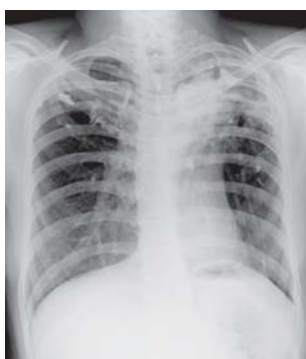


Fig. 5.25

OPINION

Chest X-ray is the first line of investigation to detect widespread fine nodules.

Pulmonary tuberculosis.

CLINICAL DISCUSSION

The disease occurs as a result of reactivation of dormant tubercular bacilli during periods of immune-suppression, malnutrition or as a result of aging. Reactivation usually occurs in the secondary foci in the apical and posterior segments of the lower lobes. Almost exclusively in adults and the distinguishing features include a predilection for the upper lobes, absence of lymphadenopathy and a propensity for cavitation.

Radiographic stability of the lesion and repeatedly negative sputum cultures indicate inactive disease.

Case 39

A 70 years old male came to radiology department for X-ray chest with history of cough and chest pain.



Fig. 5.26

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.26) shows a well-defined with smooth outline, rounded soft tissue density lesion in the superior mediastinum paratracheal in position, extending into left lung apex. There is no calcification in the lesion, there are no satellite lesions. There is no bony erosion of the adjacent ribs or vertebrae suggesting diagnosis of bronchogenic cyst. The lung fields are clear.

COMMENTS AND EXPLANATION

On chest radiograph bronchogenic cyst appears as a well-defined soft tissue mass. Air fluid level within lesion may be seen in case of bronchial rupture. Thin walled cystic or soft tissue lesion is seen on CT and MRI with variable density and signal intensity pattern depending on contents of the lesion being fluid, mucinous, proteinaceous, hemorrhage or secondary infection.

CT guided aspiration of the cyst contents is often offered as one of the treatment options.

OPINION

Bronchogenic cyst.

CLINICAL DISCUSSION

Bronchogenic cyst is a thin walled foregut cyst usually observed as asymptomatic middle mediastinal lesion, however, may present with cough, chest pain and dyspnea or with complications like secondary infection, hemorrhage or rupture. Commonest location is subcarinal region followed by paratracheal region and rarely posterior mediastinum.

Case 40

A 22 years old male who had worked in grain mill for two days, came to radiology department for X-ray chest with malaise, cough and chest tightness.



Fig. 5.27

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 5.27) shows bilateral basal ground glass appearance with fine soft granular opacities suggesting a possibility of Miller's lung.

COMMENTS AND EXPLANATION

Enlarged view (Fig. 5.28) of right lung base ground glass appearance with fine soft granular opacities. Miller's lung is hypersensitivity pneumonia or eosinophilic pneumonia can be classified according to etiology as (a) idiopathic/primary, (b) secondary-due to specific causes like drug/fungus/parasite induced and (c) associated with connective tissue disorders/systemic vasculitis. Unlike asthma, hypersensitivity pneumonitis targets lung alveoli rather than bronchi. Presentation may be acute with febrile illness cough and chest pain. Chest radiograph and HRCT lung are imaging modalities of choice. In acute presentation, usually with no peripheral eosinophilia, imaging features of bilateral interstitial infiltrates, ground glass opacities, interlobular septal thickening, small pleural effusion and rarely peripheral air space opacities are seen. In chronic cases, persistent peripheral areas of consolidation are seen with distinctive pattern of vertical band of consolidation unrestricted by fissures seen parallel to the chest wall, but separate from it. Miller's lung is due to *Sitophilus granarius* (wheat weevil) resulting in contaminated grain.

It should be differentiated from cryptogenic organizing pneumonia and idiopathic interstitial pneumonias.

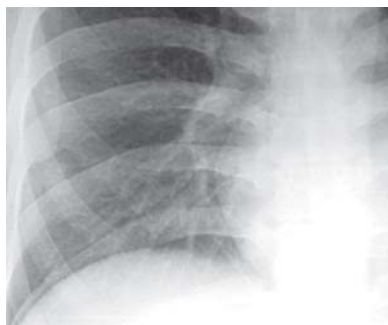


Fig. 5.28

OPINION

Miller's lung or hypersensitivity pneumonia.

CLINICAL DISCUSSION

Miller's lung or extrinsic allergic alveolitis, also known as hypersensitivity pneumonitis, is an allergic inflammatory granulomatous reaction of the

lungs caused by the inhalation of dusts much less than 10 μm in diameter containing, certain organism or proteins, inhaled particles are capable of reaching the alveoli, and damage the gas-exchanging alveoli.

If the particles are antigenic and the lung previously sensitized, a hypersensitivity reaction develops. Antibodies are meant to neutralize potentially harmful foreign material, but sometimes the combination of antigen and antibody results in a hypersensitivity reaction. Similarly, in farmer's lung the offending organism is *Micropolyspora faeni* from damp hay. Pigeon breeders inhale dust from feathers or desiccated droppings containing bird serum protein. Fungal spores from the compost used affects mushroom growers. Sugar cane workers exposed to mouldy sugar cane residue may develop bagassosis.

Case 41

A 55 years old male came to radiology department for X-ray chest with history of cough, fever, loss of appetite and weight loss.



Fig. 5.29

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.29) shows extensive infiltrative lesions in both lung fields more in both upper and mid zones. There is large thick walled cavity in RUZ with irregular inner margins. These are features of active tuberculosis.

COMMENTS AND EXPLANATION

In pulmonary Koch's widespread necrosis with cavitations, usually occur in the upper lung or apex. This is a typical feature of adult type or secondary tuberculosis. This is probably related to pre-existing hypersensitivity to *M. tuberculosis* resulting from a prior primary infection. The risk of spread of infection to non-infected persons from individuals with pulmonary Koch's with cavitary lesion is very high.

OPINION

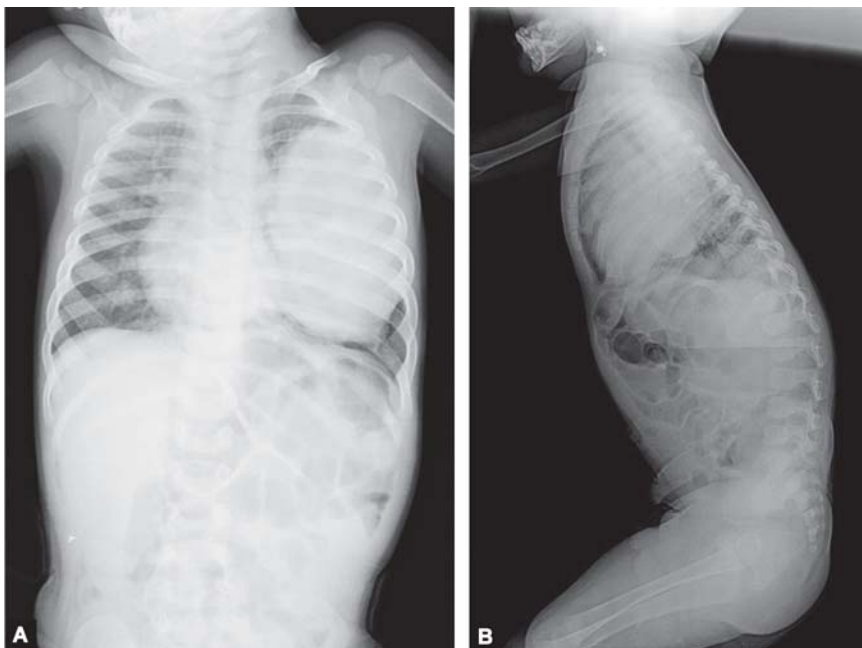
Pulmonary Koch's with cavitary lesion.

CLINICAL DISCUSSION

Cavitation typically occurs within areas of consolidation and is seen in about 45–50 percent of cases. The cavities are frequently multiple. The walls of the cavities are initially thick and irregular and progressively become thin on treatment. Sometimes mycetomas can form within the air filled cavity by saprophytic aspergillosis, cavitation can also progress to endobronchial spread of the disease. This is seen on the chest radiograph as poorly defined acinar nodules in the dependent areas of the ipsilateral and also in the contralateral lung. HRCT is more sensitive than a chest radiograph to detect this phenomenon early.

Case 42

One month old child was brought to radiology department for X-ray chest with history of persistent cough and fever.



Figs 5.30A and B

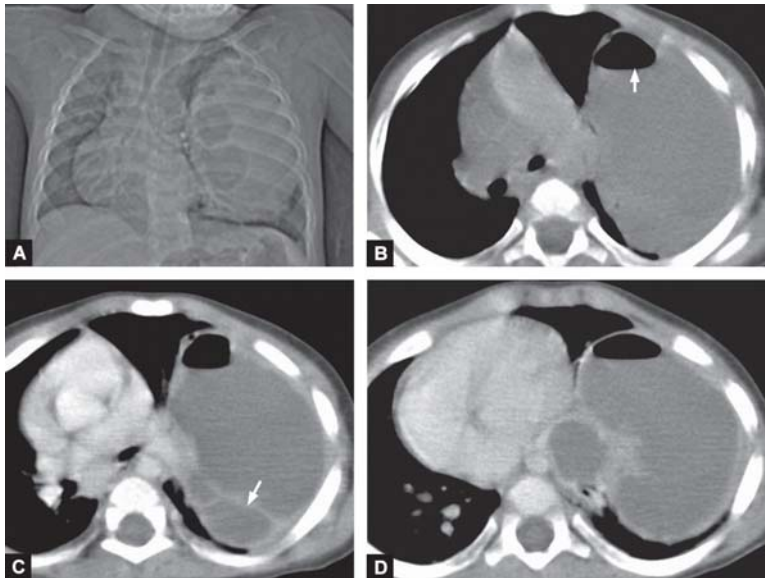
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Figs 5.30A and B) shows a single large size oval density occupying most of the left hemithorax, pushing the mediastinum and trachea to the right. There is compression of bronchus on right side. Some lung parenchyma is seen in left apex and left base.

COMMENTS AND EXPLANATION

CT chest (Figs 5.31A to D) revealed a large cyst with air fluid level with enhancing wall suggesting it to be an infected cyst. Surgical resection of the cyst was performed and diagnosis was confirmed on histopathology.

For this giant size left hemithorax cyst the differential diagnosis includes lung cyst, bronchogenic cysts and congenital cystic adenomatoid malformations (CCAMS). The histology of the lung cyst shows a columnar to cuboidal respiratory epithelial lining, surrounded by a fibromuscular wall and nests of bronchial glands consistent with CCAMS.



Figs 5.31A to D

OPINION

Cystic adenomatoid malformation.

CLINICAL DISCUSSION

In CCAMS there is absence of bronchiolar cartilage in the cystic wall as there is an embryological alteration before the sixteenth week of intrauterine life, after which the cartilaginous bronchi are formed.

CCAM is a rare fetal pulmonary lesion and is thought to be due to overgrowth of terminal bronchioles that form cysts of various sizes with suppression of alveolar development ensuing between 5 and 8 weeks of gestation. The lesion communicates with the bronchial tree and derives its vascular supply from the pulmonary circulation.

In 1977, Stocker classified three types of CCAM: Type I consists of large cysts; type II consists of small cysts; and type III shows lesions resembling a homogeneous mass, with cysts only seen on microscopy.

CCAM communicates with the bronchial tree at birth and therefore typically contains air soon after birth. The imaging appearance is determined by the size and number of cysts. CCAM is observed with equal frequency in boys and girls, does not appear to be hereditary, the lesions are confined to one lobe and seem to be predominant in the lower lobes; they may or may not occupy the whole lobe. Clinical expressions of CCAM are ranging from death in utero to respiratory distress at birth as well as the absence or the presence of pulmonary symptoms.

Pneumothorax and atelectasis may occur. Antenatal diagnosis allows preparation for immediate surgery if necessary.

Late complications of CCAM include severe or recurrent infection of the lungs and malignant change in the lesion requiring early surgery. While postnatal spontaneous resolution is noted, CCAM is the most common type of fetal thoracic mass diagnosed by prenatal ultrasonography.

Case 43

A 67 years old male came to radiology department for X-ray chest with history of cough and hemoptysis.

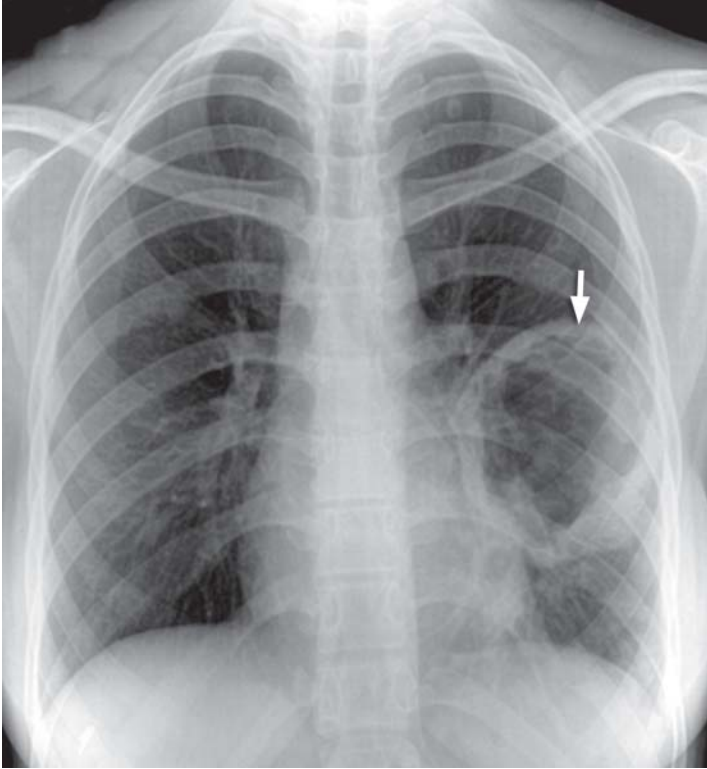


Fig. 5.32

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.32) shows a thick walled cavity, the inner margins of the cavity are irregular. There is a small area of tuberculous infiltration seen inferior to the cavity.

COMMENTS AND EXPLANATION

CT chest (Fig. 5.33) was performed which confirmed the plain film findings. Necrosis with cavitation is a characteristic feature of “secondary” tuberculosis. This is the result of a pre-existing hypersensitivity to *M. tuberculosis* resulting from a prior primary infection.

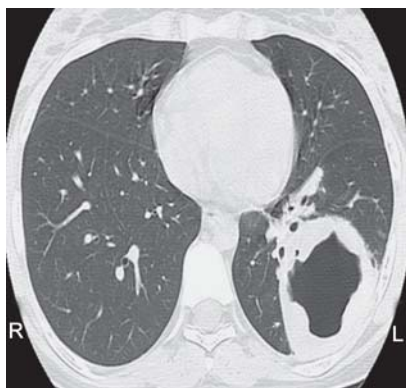


Fig. 5.33

OPINION

Cavitory tuberculosis.

CLINICAL DISCUSSION

Cavities generally involve the wall of an airway with necrotic material is discharged into the bronchial tree from where it is coughed out and may infect others, the risk of spread of infection to non-infected persons from individuals with cavitory tuberculosis is very high. The infected material may show in other parts of the lung via the airways to produce a tuberculous bronchopneumonia or if swallowed, infection of the gastrointestinal tract may result. Communication of the centers of the tuberculous lesions with the airway exposes the bacteria to a high concentration

Extensive necrosis with cavitations, usually occurring in the upper lung or apex, is a characteristic feature of secondary or adult type of tuberculosis. This is probably related to pre-existing hypersensitivity to *M. tuberculosis* resulting from primary infection. Cavities form when necrosis involves the wall of an airway and the semi-liquid necrotic

material is discharged into the bronchial tree from where it is usually coughed up and may infect others. This infected material may seed other parts of the lung via the airways to produce a tuberculous broncho-pneumonia. If swallowed, infection of the gastrointestinal tract may result. Communication of the tuberculous lesions with the airway exposes the bacteria to a high concentration of oxygen and promotes their proliferation. The risk of spread of infection to non-infected persons from individuals with cavitary tuberculosis is very high.

Case 44

A 28 years old male came to radiology department for X-ray chest with history of cough and fever of 2 days duration.



Fig. 5.34

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.34) shows non-homogeneous shadowing in right upper zone suggest a developing consolidation. The lower margin is sharply bordered by the horizontal fissure which is concave downwards suggesting right upper lobe (RUL) consolidation with volume loss because of partial collapse.

COMMENTS AND EXPLANATION

Enlarged view of RUL (Fig. 5.35) shows non-homogeneous shadowing; no air bronchogram can be appreciated at this stage of developing consolidation. The concave downwards lower margin suggests volume loss in consolidating right upper lobe (RUL).

On imaging consolidation appears as a homogeneously increased opacity in the segmental or lobar distribution with or without air bronchogram within it. It may be limited by fissures. There is no loss of lung volume in contrast to atelectasis where increased opacity is associated with loss of lung volume. With treatment density reduces as air returns to the lobe.



Fig. 5.35

OPINION

Developing consolidation RUL.

CLINICAL DISCUSSION

Consolidation is a clinical term for solidification into a firm, dense mass. It is more specifically used in reference to a region of lung tissue that, normally compressible, has filled with liquid. It is a condition marked by induration swelling or hardening of normally soft tissue of a normally aerated lung. Consolidation occurs through accumulation of inflammatory cellular exudates in the alveoli and adjoining ducts. More specifically, it is defined as alveolar space that contains liquid instead of gas. The fluid can be pulmonary edema, inflammatory exudate, pus, inhaled water, or blood from bronchial tree or haemorrhage from a pulmonary artery.

Case 45

A 43 year old female came to radiology department for X-ray chest with history of cough, fever, weight loss and loss of appetite since two months.

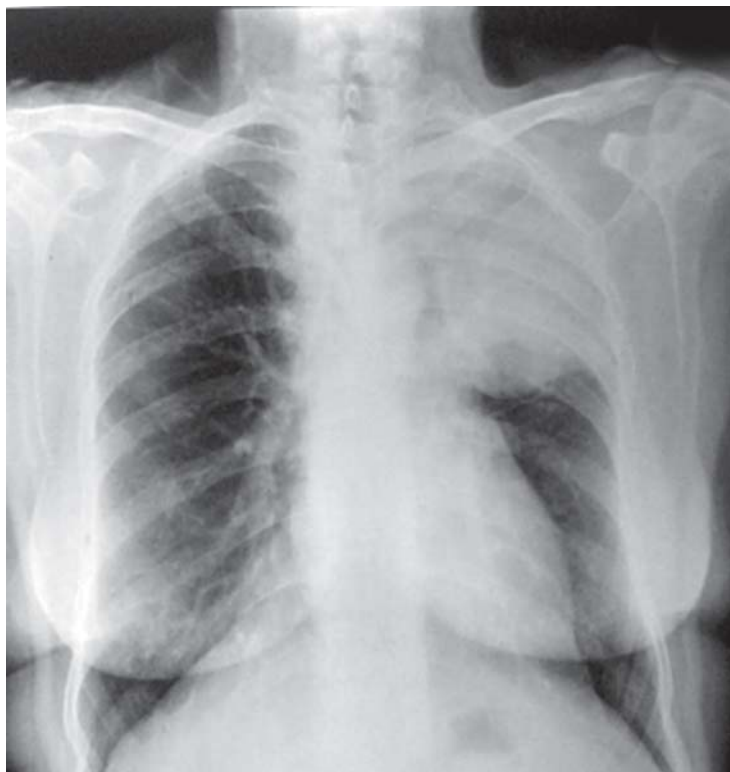


Fig. 5.36

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest PA view (Fig. 5.36) shows a 5×6 cm oval to circular lesion located in the apex of the left lung likely to be a cyst.

COMMENTS AND EXPLANATION

CT scan chest was performed, section at the level of aortic arch (Fig. 5.37) a round cystic lesion is seen in the left upper lobe with enhancement of the wall, another small cystic lesion is lying anterior to this. It was diagnosed as hydatid cyst.

USG features can be similar to simple cysts with acoustic enhancement, it may contain some hydatid sand, and daughter cysts may be present. The cyst may become densely calcified.



Fig. 5.37

OPINION

Hydatid cyst.

CLINICAL DISCUSSION

Hydatid disease is infestation by *Echinococcus granulosus* (parasitic tapeworm).

Life cycle—*Echinococcus granulosus* tapeworm lives in the intestine of the dog (definitive host). The dog excretes the eggs in the feces which when swallowed by the intermediate hosts—humans, sheep, cattle, goats, the embryos are released from the egg into the duodenum and pass through the mucosa to the liver through the portal venous system. Most of the embryos remain trapped in the liver, although may reach lungs, kidneys, spleen, CNS and bone.

In the liver, the right lobe is more commonly involved. Surviving embryo develops into a slow growing cyst. The cyst wall consists of an

external membrane that is approximately one mm thick called ectocyst which may calcify. Host forms a dense connective tissue capsule around the cyst termed as pericyst. The inner germinal layer or the endocyst gives rise to brood capsules that enlarge to form protoscolices. The brood capsules may separate from the wall and form fine sediment called hydatid sand. When hydatid cysts within the organ of an herbivore are eaten, the scolices attach to the intestine and grow to adult tapeworm, thus completing life cycle.

Treatment is by surgery. Percutaneous drainage of cyst under imaging guidance can be done.

Case 46

A 23 years old male came to radiology department for X-ray chest with history of cough and fever.



Fig. 5.38

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On X-ray chest (Fig. 5.38) a dense white opacity is seen in right upper zone extending to middle zone. The lower margin is sharply bordered by the horizontal fissures suggesting right upper lobe (RUL) consolidation.

COMMENTS AND EXPLANATION

RUL consolidation is simple and easy to diagnose as it is not hidden by heart or diaphragm. On lateral view in RUL consolidation, the opacity may be sharply bordered by the horizontal fissure anteriorly and oblique fissure posteriorly. The RUL is made up of three segments: apical, posterior, and anterior.

OPINION

Right upper lobe consolidation.

CLINICAL DISCUSSION

On imaging consolidation appears as a homogeneously increased opacity in the segmental or lobar distribution with or without air bronchogram within it. It may be limited by fissures. There is no loss of lung volume in contrast to atelectasis where increased opacity is associated with loss of lung volume. With treatment density reduces as air returns to the lobe.

Radiological consolidation may lag behind clinical pneumonia in early phase. Radiological resolution of consolidation lags behind the clinical signs. Hence X-ray should be repeated after at least 2 weeks of proper treatment. Complication of pneumonia can be (a) pleural effusion and empyema (b) hydropneumothorax (c) abscess formation and (d) bronchiectasis.

Case 47

A 54 years old male came to radiology department for X-ray chest with history of cough and breathlessness on exertion.

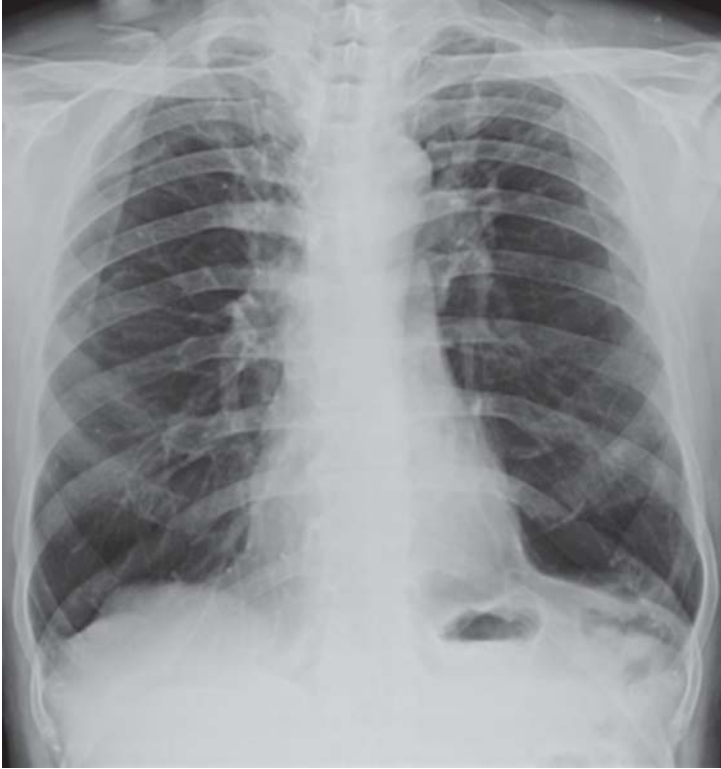


Fig. 5.39

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 5.39) shows that the lungs are hyperinflated, the diaphragm is low lying and flat. The peripheral vascular pattern is attenuated more prominently in the mid and lower zones. The central pulmonary arteries are enlarged, indicating pulmonary arterial hypertension. The heart is elongated. These are features of emphysematous chest.

COMMENTS AND EXPLANATION

If lateral chest projection is made, due to increased lung volume, the chest becomes barrel shaped and the retrosternal space is deeper than normal and extends more inferiorly than normal. CT chest (Fig. 5.40) shows bilateral hyperlucent lungs with small air pockets of dilated coalesced alveolar ducts and alveolar sacs (arrow).

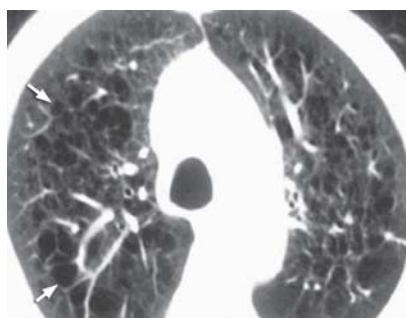


Fig. 5.40

OPINION

Emphysematous chest.

CLINICAL DISCUSSION

Emphysema is defined as enlargement of the airways beyond the terminal bronchi, with destruction of their walls and resultant dilatation. Gas exchange takes place beyond the terminal bronchioles whereas the trachea, bronchi and terminal bronchioles are only conducting airways and the alveolar ducts and alveolar sacs are both conducting and respiratory structures. The alveoli are purely respiratory in function.

Case 48

A 44 years old male came to radiology department for X-ray chest with history of cough and chest pain.



Fig. 5.41

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.41) shows a mass lesion occupying left apex with possibly destruction of ribs, trachea is pushed to the right.

COMMENTS AND EXPLANATION

Penetrated view chest (Fig. 5.42) was performed to see the involvement of adjacent ribs, which revealed in addition to mass in the left apex, destruction of 1st and 2nd ribs on the left side, and was diagnosed, as pancoast tumor.

Carcinoma of the apex of the lung is termed as Pancoast tumor or superior sulcus tumor (Fig. 5.41) that may involve the brachial plexus and sympathetic ganglion of the lower neck and upper mediastinum.



Fig. 5.42

OPINION

Pancoast tumor.

CLINICAL DISCUSSION

A Pancoast tumor is an apical tumor that is typically found in conjunction with a smoking history. The clinical signs and symptoms can be confused with neurovascular compromise at the level of the thoracic outlet. The patient's smoking history, rapid onset of clinical signs and symptoms and pleuritic pain can suggest an apical tumor. A Pancoast tumor can give rise to both Pancoast syndrome and Horner's syndrome. When the brachial plexus roots are involved, it will produce Pancoast syndrome; involvement of sympathetic fibers as they exit the cord at T1 and ascend to the superior cervical ganglion will produce Horner's syndrome.

Bronchogenic carcinoma or metastatic lesion is the commonest cause of Pancoast tumors, other causes are lymphoma, mesothelioma, and multiple myeloma. Pancoast syndrome is a clinical triad of (a) Horner's syndrome (ptosis, miosis, anhidrosis, and enophthalmos), (b) ipsilateral arm pain and (c) wasting of the hand muscles. The Pancoast tumors are best depicted on the coronal and sagittal MR images.

Case 49

One year old child was brought to radiology department for X-ray chest with history of cough and fever.



Fig. 5.43

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.43) shows that the apex of right lung is aerated and dense opacity is seen below the apex. The lower border of this consolidation area is not well delineated. A diagnosis of consolidation involving posterior segment RUL was made.

COMMENTS AND EXPLANATION

When the lower border of this consolidation area in the RUL is not well-delineated and the apex of right lung is aerated, it means that it is not limited by the horizontal fissure suggesting the consolidation lies in the posterior segment of the RUL and not in the anterior segment. Had it been in the anterior segment of the RUL, the lower border should have been well-delineated, i.e. being limited by the horizontal fissure.

OPINION

Consolidation posterior segment RUL.

CLINICAL DISCUSSION

Radiological consolidation may lag behind clinical pneumonia in early phase. Radiological resolution of consolidation lags behind the clinical signs. Hence X-ray should be repeated after at least 2 weeks of proper treatment. Non-resolution of the consolidation for 3 weeks even after appropriate medical therapy should raise possibility of malignant etiology as the underlying cause.

Case 50

A 75 years old male came to radiology department for X-ray chest with history of acute chest pain. Patient had history of deep vein thrombosis of both lower limbs.

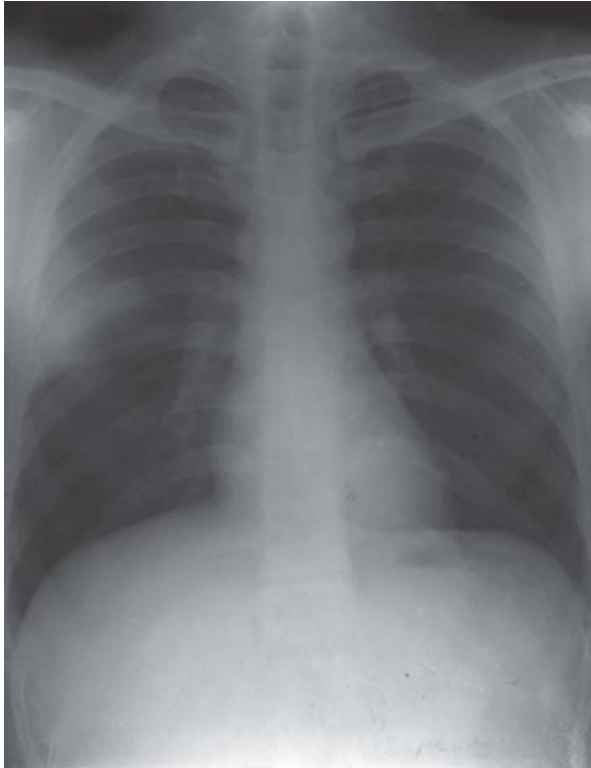


Fig. 5.44

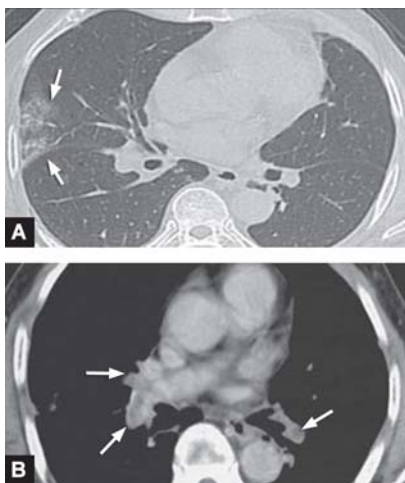
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.44) shows on right side a wedge shaped peripheral area of consolidation suggesting the diagnosis of pulmonary infarct.

COMMENTS AND EXPLANATION

This patient had both lower limbs deep vein thrombosis, with left femoral vein thrombus extending into inferior vena cava (IVC) and came with acute chest pain, was diagnosed as pulmonary infarction.

The diagnosis was confirmed on CT chest which shows a wedge-shaped infarct in the lateral segment of right middle lobe (Fig. 5.45A). CT pulmonary angiography image (Fig. 5.45B) shows an embolus in right as well as posterior branch of left pulmonary artery, seen as soft tissue density filling defect with near complete occlusion of right pulmonary artery at its bifurcation extending into segmental branches (arrows).



Figs 5.45A and B

OPINION

Pulmonary embolism.

CLINICAL DISCUSSION

A pulmonary embolus is most often caused by a blood clot in one of the deep veins of the thighs, in case of deep vein thrombosis (DVT). The DVT breaks off and travels to the lungs leading to pulmonary embolus.

The clot travels through the vessels of the lung continuing to reach smaller vessels until it becomes wedged in a vessel that is too small to allow it to continue further. The clot blocks all or some of the blood from

traveling to that section of the lung. These blockages result in areas of disruption of blood to a part of the lung and do not allow the carbon dioxide waste to be delivered to the air sacs for removal. Similarly, since blood is blocked to certain portions of the lung, oxygen cannot be extracted from these same air sacs, i.e. is perfusion, as a result areas in the lung are ventilated but get no blood to exchange the waste product carbon dioxide with oxygen.

If the pulmonary embolism is large, the patient cannot get enough oxygen into the blood and can become acutely short of breath. In some instances, clots are so large that blood flow is blocked from the right side of the heart entering the lungs. This can result in instantaneous death. In other patients, the mismatch is not so profound, but still causes symptoms, especially when oxygen demand increases during exercise. Pulmonary infarction is unusual because of collateral circulation.

Less common causes include air bubbles, fat droplets, amniotic fluid, or clumps of parasites or tumor cells, all of which may lead to a pulmonary embolus.

Case 51

A 40 years old male came to radiology department for X-ray chest with history of cough, malaise and loss of appetite.

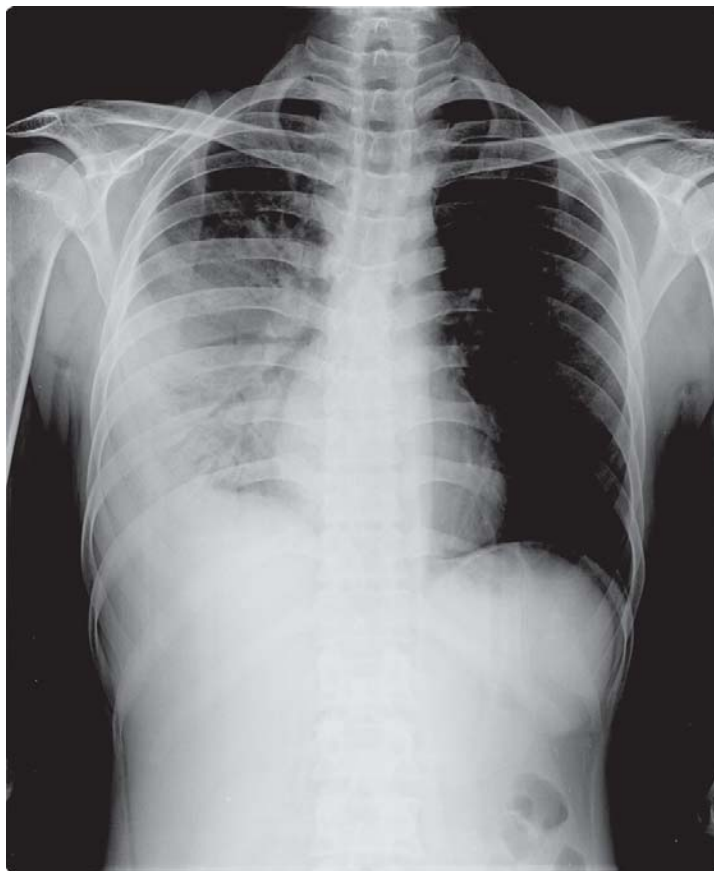


Fig. 5.46

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest shows (Fig. 5.46), extensive homogeneous white shadowing in the mid and lower zone of right lung. The lower lobe bronchus is beautifully delineated almost along its entire course; it is seen outlined in black against the white background area of consolidated lung, this is air bronchogram.

COMMENTS AND EXPLANATION

Consolidation may be due to (a) Infections-bacterial-*Staphylococcus aureus*, *Streptococcus pneumoniae*, *Klebsiella*, *Mycobacterial tuberculosis*, *Mycoplasma pneumoniae* or *Pneumocystis carinii* (b) Neoplasms-bronchogenic carcinoma, lymphoma (c) Acute respiratory distress syndrome (d) Traumatic contusion.

Streptococcus pneumoniae is a common cause of pneumonia particularly in young adults but is seen in all age groups. It characteristically produces basal lobar consolidation with air bronchogram, but may occur anywhere in the lung. Occasionally, edema of the interlobular septa causes septal lines. Pleural effusion, empyema and cavitation may develop unless infection is treated promptly, but may be seen more frequently in debilitated patients. Resolution is usually complete without any residual effects.

OPINION

Consolidation with air bronchogram.

CLINICAL DISCUSSION

Consolidation is a feature of bacterial pneumonias. There is a radio-opacity in the lung field. Air bronchograms can be seen within the radio-opacity on chest radiographs. Silhouette sign may be seen in which the margins between the consolidation and mediastinal or diaphragmatic borders would be lost.

Streptococcus pneumoniae is a common cause of pneumonia particularly in young adults but is seen in all age groups. It characteristically produces basal lobar consolidation with air bronchogram, but may occur anywhere in the lung. Occasionally, edema of the interlobular septa causes septal lines. Pleural effusion, empyema and cavitation may develop unless infection is treated promptly, but may be seen more frequently in debilitated patients. Resolution is usually complete without any residual effects.

Case 52

A 45 year old female came to radiology department for X-ray chest with history of dry cough and dyspnea of one year duration.



Fig. 5.47

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.47) shows bilateral extensive interstitial fibrosis with coarse nodules scattered unevenly in both lung fields. Questionable small pneumothorax is seen in left apex.

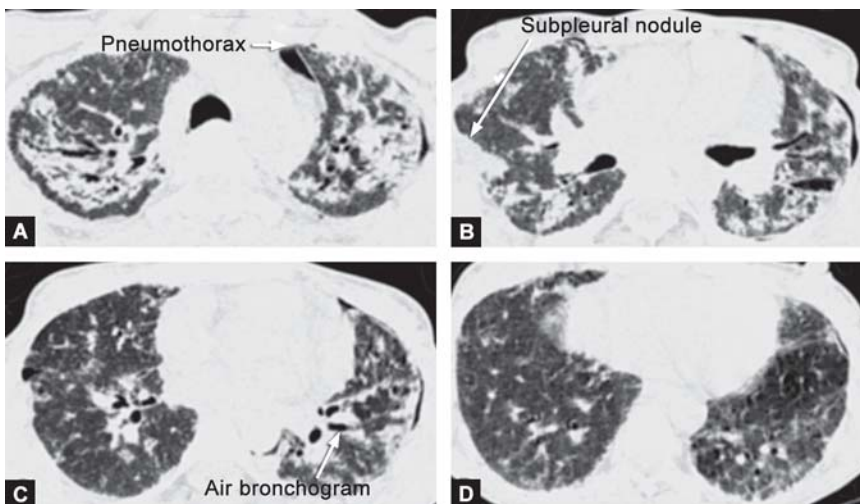
COMMENTS AND EXPLANATION

High resolution CT (HRCT) thorax (Figs 5.48A to D) was performed which revealed evidence of bilateral extensive interstitial fibrosis with associated air bronchogram. Coarse nodules are seen scattered unevenly in both lung fields with septal and subpleural nodules. Few bullae are seen in left upper lobe peripherally. Pneumothorax is noted in left apical and upper zone due to ruptured bullae. Ground glass appearance is seen in left lower zone. No evidence of any mediastinal lymph nodes seen suggesting diagnosis of sarcoidosis.

In sarcoidosis the incidence of parenchymal lesion is often seen and these lesions are significantly higher on high resolution CT than on chest radiography.

Sarcoidosis on HRCT shows widespread small multiple irregular nodular opacities which are distributed predominantly subpleural and around the bronchovascular bundles.

The nodules may be well or poorly margined and may coalesce to form larger opacities. Large nodules can be up to one cm in diameter. The distribution of the nodular opacities is so profuse that they may often appear as miliary shadows or as ground-glass opacification more frequently seen in midzones.



Figs 5.48A to D

OPINION

Sarcoidosis.

CLINICAL DISCUSSION

Sarcoidosis is a disease of unknown etiology and patients can be asymptomatic. It affects many organs in the body like the lung, brain, heart, liver, spleen, lymph nodes, skin and bones. The diagnosis depends on demonstrating non-caseating granulomas on histopathology specimens with clinico-radiological correlation. On chest radiographs main findings include: (i) hilar and paratracheal and/or mediastinal lymphadenopathy, which is bilateral and symmetrical in most cases. (ii) Reticulonodular shadowing in both lung fields may be seen as small nodular shadows in mild cases to coarse reticular shadows predominantly in upper and mid lung zones. Pulmonary fibrosis in apical lung zones indicate advanced disease. Transbronchial biopsy for demonstrating non-caseating granulomas would be useful. Some patients may have other manifestations like weight loss, uveitis, reduced exercise tolerance, fever, iridocyclitis, polyarthrititis and erythema nodosum. CT scan can show mediastinal and hilar lymphadenopathy, lung parenchymal involvement is also visualized better.

Staging in sarcoidosis

Stage 0 No abnormal radiological findings

Stage 1 Bilateral hilar/mediastinal lymphadenopathy

Stage 2 Bilateral hilar lymphadenopathy with lung parenchymal involvement

Stage 3 Only lung parenchymal involvement

Stage 4 Pulmonary fibrosis, irreversible.

Case 53

A 50 years old patient came to radiology department for X-ray chest with history of cough for two weeks and failure to respond to antibiotics.



Fig. 5.49

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.49) shows a well-defined, rounded homogeneous radio-opacity measuring 3 cm in diameter in left upper zone, surrounding lung parenchyma is normal and was diagnosed as solitary pulmonary nodule (SPN).

COMMENTS AND EXPLANATION

SPN seen is well-defined, rounded homogeneous radio-opacity, the surrounding lung parenchyma is normal (Fig. 5.50). CT chest revealed a heterogeneously enhancing solitary pulmonary nodule in left lung which was proved to be a bronchogenic carcinoma.

Solitary pulmonary nodule (SPN) or coin lesion is a round to oval lesion in the lung smaller than 3 cm in diameter. If it is more than 3 cm in diameter it is called a mass. It appears as a distinct discrete white area in the lung on chest radiograph. The smaller the nodule, it is more likely to be benign. It can be an incidental finding and most commonly represents a benign tumor such as a granuloma or hamartoma, but in around 20% of cases it is a malignant especially in smokers and individuals above the age of 40 years.

SPN with smooth well-defined margin are likely to be benign and SPN with irregular speculated margin are likely to be malignant. Calcification in the nodule suggests the lesion as benign, however, eccentric calcification suggests malignancy.

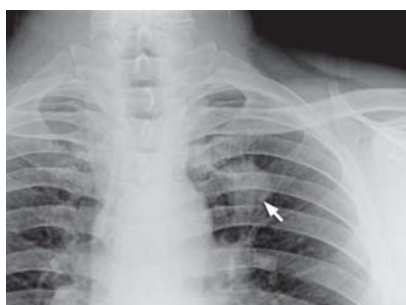


Fig. 5.50

OPINION

Solitary pulmonary nodule or coin lesion in left upper zone confirmed as bronchogenic carcinoma.

CLINICAL DISCUSSION

The diagnosis of a solitary spherical shadow on a chest radiograph is common, size less than 3 cm is called as solitary pulmonary nodule,

while size more than 3 cm is called as lung mass. If the lesion is more than 3 cm in diameter it is likely to be malignant in 90% of cases. Most patients are asymptomatic. The usual causes are (i) bronchial carcinoma/carcinoid (ii) pulmonary hamartomas (iii) infective granulomas, like tuberculomas and (iv) metastasis.

To evaluate SPN one must compare with older X-rays, if available. This is important because doubling time of most malignant SPN's is 1 to 6 months, and any nodule that grows more slowly or quickly is likely to be benign. CT scan is usually considered an essential follow up to the chest X-ray.

Other features that support a benign solitary pulmonary lesion are: smooth margins, calcifications within the lesion, fat density within the lesion, poor contrast enhancement on CT scan, wall calcification of the lesion, constant size on follow up radiographs, doubling time less than 1 month or more than 18 months, FDG-PET scan uptake is negative.

Features that indicate malignancy are: size more than 3 cm, irregular margins, ground glass density on CT (20–100 HU), coarse calcifications within the lesion, no fat density within the lesion, contrast enhancement on CT scan, cavitation within the lesion, doubling time is more than 1 month and less than 18 months, previous radiograph comparison reveal changes in size or shape, FDG-PET scan shows positive uptake.

CT guided biopsy reveals the underlying pathology. Treatment depends on the pathology.

Case 54

A 33 years old male came to radiology department for X-ray chest with history of persistent cough and weight loss since 5 months.

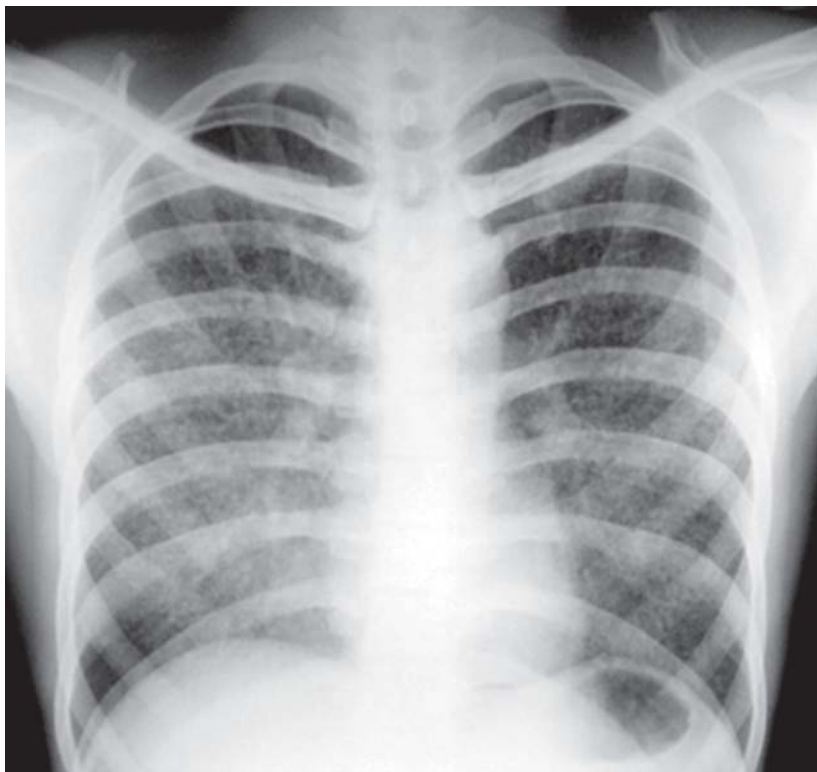


Fig. 5.51

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

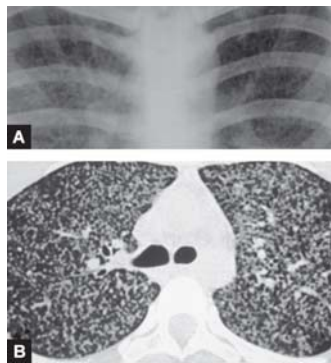
X-ray chest shows multiple small rounded densities of roughly the same size scattered throughout both lungs. This pattern of small nodules is called 'miliary' (Fig. 5.51). No hilar or mediastinal adenopathy seen.

COMMENTS AND EXPLANATION

Enlarged view of Figure 5.52A and CT scan section of the same patient confirms the X-ray findings. However, on CT the miliary nodules are discrete, roughly the same size scattered throughout both lungs (Fig. 5.52B).

Miliary tuberculosis results from hematogenous or bronchogenic spread from the primary focus. It is seen commonly in the elderly and children below 2 years of age and in immunocompromised patients. Radiological features on chest X-ray are multiple, well-defined, 2–5 mm miliary mottling diffusely and evenly distributed throughout the lung fields with slight lower lobe predominance. High resolution CT is more sensitive in detection of these nodules.

These nodules may enlarge and coalesce to form areas of consolidation if untreated. Ground glass opacities are second most common finding in miliary tuberculosis. HRCT identifies the extent of pulmonary Koch's, especially subtle areas of consolidation, cavitation, bronchogenic and miliary spread. The differential includes sarcoidosis, metastases or silicosis, and occupational lung disease from exposure to silica dust.



Figs 5.52A and B

OPINION

Miliary tuberculosis.

CLINICAL DISCUSSION

Pulmonary tuberculosis is caused by *M. tuberculosis*. Sputum test positive for acid fast bacilli confirms the diagnosis. Radiology plays an important

role in diagnosing and evaluating the therapeutic response. There are two main forms of pulmonary tuberculosis—primary and postprimary tuberculosis. Primary tuberculosis occurs in children. Postprimary tuberculosis occurs mostly in adults.

Spread of primary tuberculosis may occur: (i) Through the bronchi to other lung segment and to the opposite lung. (ii) Hematogenous dissemination to lungs and rest of organs in body as miliary tuberculosis.

In miliary tuberculosis there are widespread well-defined discrete small same size nodules in both lungs on chest radiographs. In advanced cases these discrete nodules may appear as confluent. Pleural effusion may occur. Miliary tuberculosis indicates active tuberculosis.

Consolidation with lung abscess.

Case 55

A 68 years old male came to radiology department for X-ray chest with history of cough and fever since 15 days.



Fig. 5.53

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

There is an area of pneumonic consolidation in right middle zone extending to lower zone but is not limited to any specific lobe. Its margins are not very well-defined. It has a central cavity which contains fluid due to necrosis and breakdown leading to a lung abscess in an area of consolidation. Air fluid level can be appreciated in the abscess.

COMMENTS AND EXPLANATION

The air fluid level seen in the abscess is not the anterior part of rib (Fig. 5.53), this can be understood if it is compared with anterior end of a rib above and a rib below, and see where the anterior ends of these ribs end.

The resolution of pneumonic consolidation often takes 6 weeks and lack of resolution indicates the presence of a neoplasm. This patient is at risk of a bronchial carcinoma being over 40 and a smoker. The film should therefore be repeated at 3 weeks and 6 weeks to ensure the area of infection is resolving. If no significant improvement is seen, the patient should undergo CT scan and bronchoscopy to identify or exclude any underlying neoplasm. In this case, there was considerable regression at 3rd and 6th week reviews.

OPINION

Consolidation with lung abscess.

CLINICAL DISCUSSION

Consolidation is a feature of bacterial pneumonias. There is a radio-opacity in the lung field. Air bronchograms can be seen within the radio-opacity on chest radiographs. Silhouette sign may be seen in which the margins between the consolidation and mediastinal or diaphragmatic borders would be lost. Abscess formation within a consolidation is recognized by cavity formation. This cavity formation occurs once there is a communication with the bronchial tree which allows the liquefied center of abscess cavity to be sucked out during repeated coughing. The liquefied center of abscess is then replaced by air which appears as transradiancy within the consolidation. Sometimes an air fluid level may form within the abscess cavity. Consolidation with cavitation may be seen in pulmonary infarction and Wegener's granulomatosis. CT scan can help to visualize the consolidation in pulmonary segments with abscess formation. Some complications of consolidation with lung abscess are empyema formation and septic emboli.

Treatment includes intravenous antibiotics according to sensitivity and postural drainage.

Case 56

A 36 years old patient came to radiology department for X-ray chest with history of cough, fever and loss of appetite.

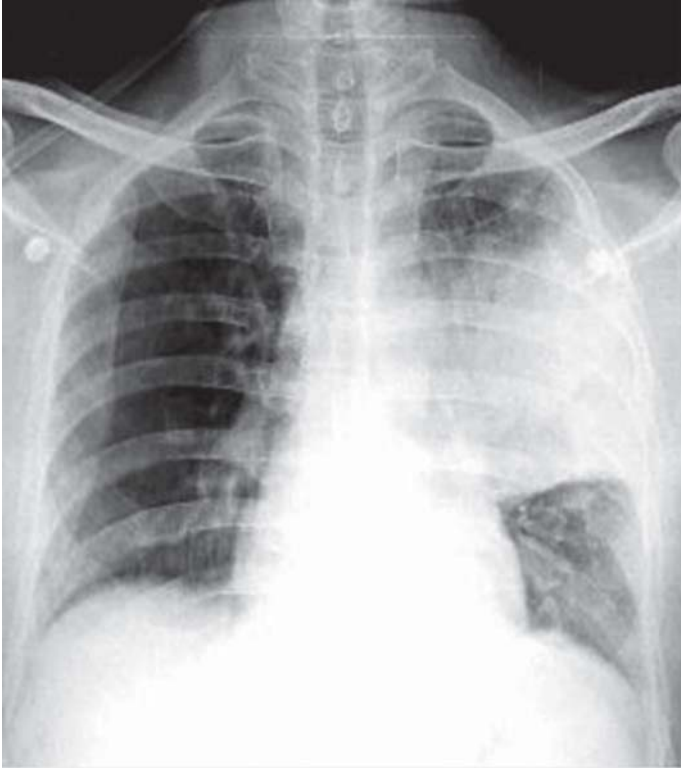


Fig. 5.54

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.54) shows an area of consolidation in left lung field midzone (lingual), the left border of heart in that area merges with the consolidation.

COMMENTS AND EXPLANATION

When a part of lung that is adjacent to heart, e.g. the right middle lobe or the lingula on left side is consolidated then its density becomes same as that of heart and merges with it so that it cannot be seen separately from heart and this is called - the Silhouette sign (by Felson). Right middle lobe and lingular pathology obliterates the adjacent heart border.

OPINION

Consolidation lingula.

CLINICAL DISCUSSION

The term consolidation does not imply any particular etiology or pathology. Acute pneumonia is the commonest cause but not the only cause of consolidation. Other causes include chronic pneumonia, pulmonary edema and neoplasm. From the imaging view point, the presence of consolidation simply means that some of the lung airspace has been replaced by a fluid. Consolidation may be complete or incomplete, and distribution of consolidation could be described as patchy, homogeneous, or generalized.

The silhouette sign is the most important clue to the location of consolidation in lung segments. In the case of lingular lobe consolidation there is obliteration of lower left cardiac border on chest radiograph. There is forward displacement of lower half of the major fissure seen well on lateral views. There is adjacent pleural reaction in left costophrenic angle.

Case 57

A 52 years old male came to radiology department for X-ray chest with history of dry cough and dyspnea on exertion for three months.

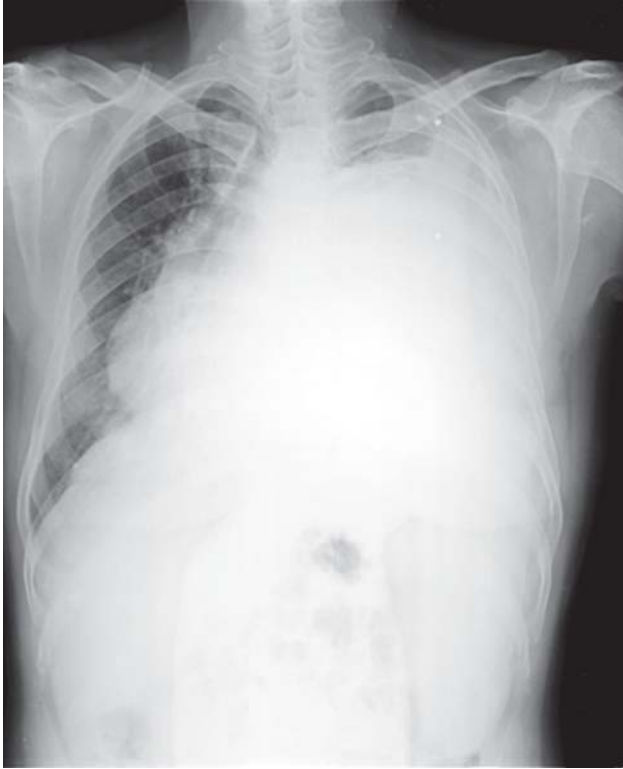


Fig. 5.55

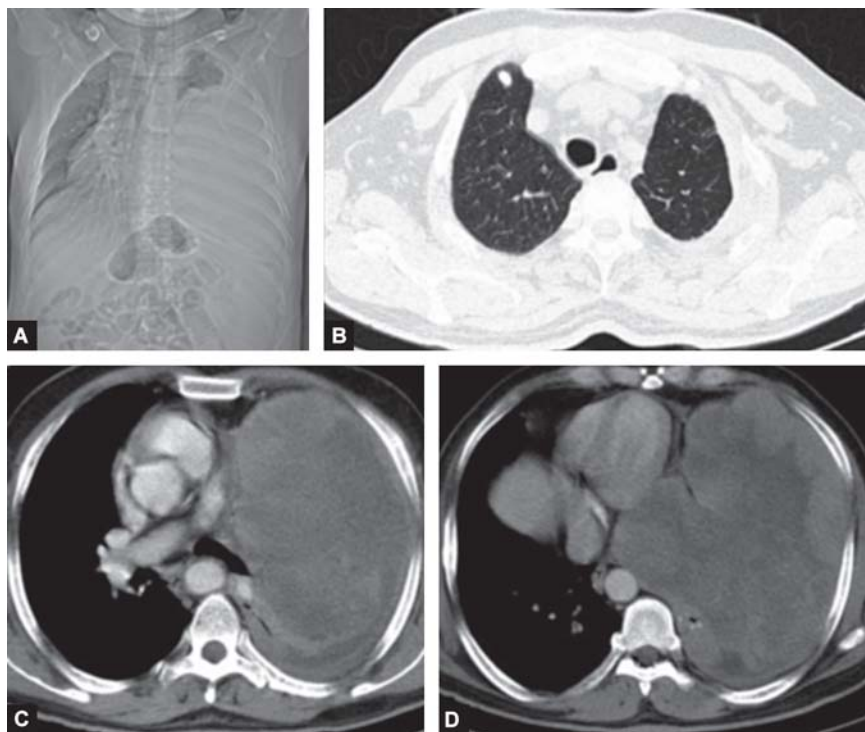
RADIOLOGICAL FINDINGS ON X-RAY AND CT EXAMINATION

Chest X-ray (Fig. 5.55) shows opaque left hemithorax with superior margin rounded, sparing the apex. The trachea and the mediastinum are pushed to the right. The left diaphragm is pushed downwards as seen from the air in the stomach. Suggesting pleural fluid with a large mass in left lung.

COMMENTS AND EXPLANATION

When the dome of diaphragm is pushed downwards as in this case it can be seen from the air in the stomach, the diaphragm becomes concave upwards. These findings suggest pleural fluid with a large mass lesion in the left lung likely to be carcinoma lung.

CT chest (Figs 5.56A to D) was done, it shows a large soft tissue density heterogeneous mass lesion measuring 17×13 cm, with mild heterogeneous post contrast enhancement seen in left hemithorax having mean CT density of 36 HU. There is collapse of LLL and partial collapse of LUL (Fig. 5.56D) sparing the apical segment. The mediastinal (Fig. 5.56C) margins of the mass lesion appear infiltrating with loss of fat planes with the mediastinum. Left pleural collection is present secondary to the mass lesion.



Figs 5.56A to D

The trachea and mediastinum are pushed to the right. A small focal lesion is seen in the anterior segment of RUL (Figs 5.56A and B). CT chest findings suggest carcinoma lung with metastasis in right lung with malignant pleural effusion.

OPINION

Carcinoma lung with malignant pleural effusion.

CLINICAL DISCUSSION

The pleural fluid could be transudate, exudate or blood; they have similar findings on chest radiograph. The clinical history is valuable in narrowing to the diagnosis of malignant pleural effusion. Large pleural effusions may obscure the lung masses. Ultrasound is a simple method of determining the presence of pleural fluid and also useful to guide pleural fluid tapping. Pleural fluid usually accumulates in the costophrenic angles when small in quantity and before it obscures the lung on chest radiographs. Pleural effusion has a sharp upper margin which is concave and higher in position towards the lateral chest wall.

Pleural effusions may occur from pleural metastatic deposits which are best seen on CT scan as nodular or mass-like pleural thickening. Malignant effusions are usually large and may appear as “white out” of the hemithorax. Large malignant pleural effusions may cause mediastinal shift to the opposite side and may present with respiratory distress.

Case 58

A 33 years old male came to radiology department for X-ray chest with history of cough, fever and weight loss for several months.

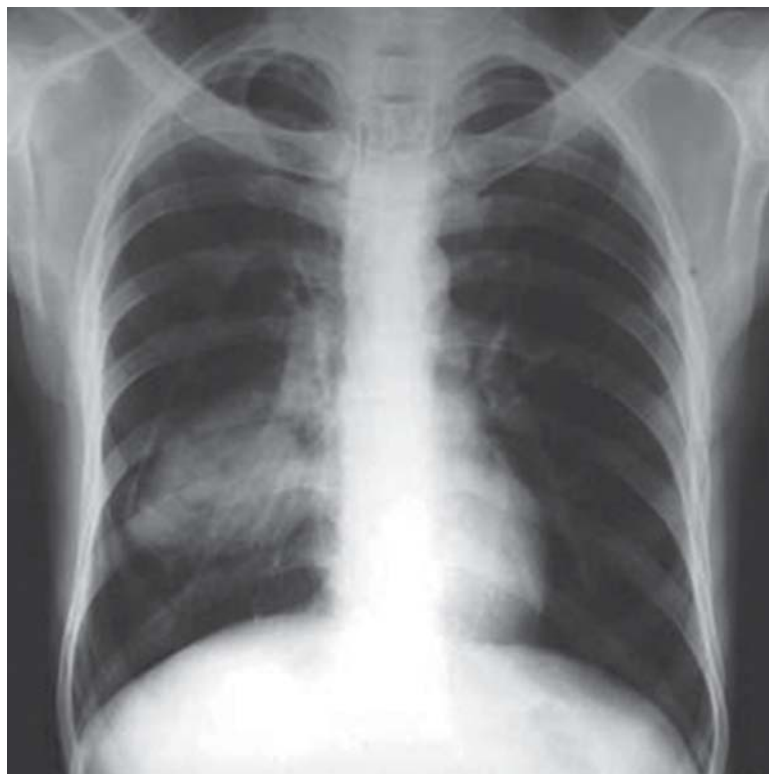


Fig. 5.57

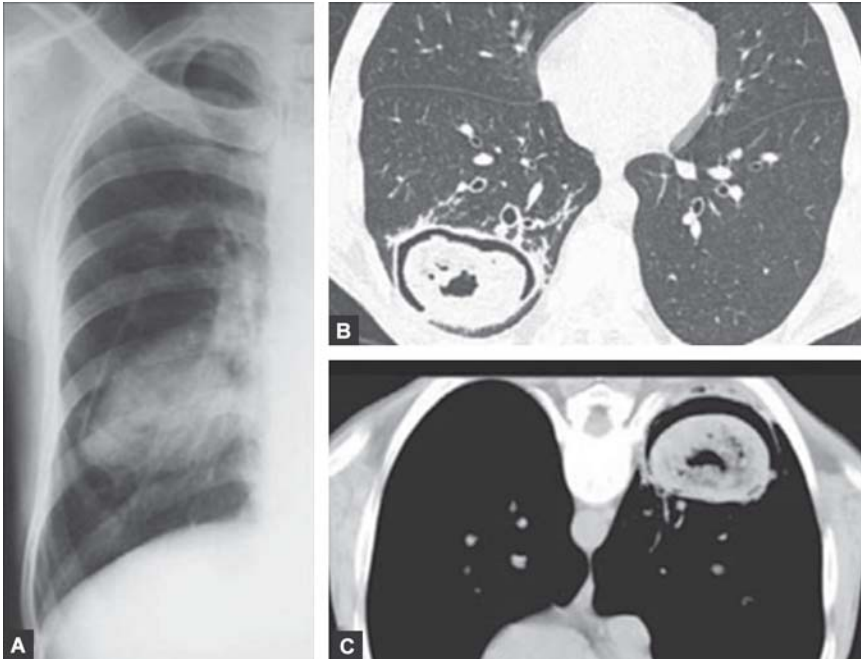
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest PA view (Fig. 5.57), demonstrates a well-defined cavity in right lower zone with fairly well-demarcated opacity seen within it suggesting fungal etiology.

COMMENTS AND EXPLANATION

CT chest (Figs 5.58A to C) was done. It shows a thick walled cavity in the right lower lobe with a fungal ball inside the cavity (Fig. 5.58B). Fungal ball has moved to the dependent position when CT chest was performed in prone position (Fig. 5.58C).

The lung cavity is often not completely filled with the *Aspergillus* ball as a result a small crescent of air is generally appreciated. The fungal ball lies free in the cavity and its position is gravity dependant.



Figs 5.58A to C

OPINION

Fungal ball.

CLINICAL DISCUSSION

Aspergillosis can lead to allergic bronchial asthma or incite allergic alveolitis. Fungal lung infection is probably from hematogenous spread.

It develops from the spores of *A. fumigatus*. The fungal ball may calcify in a rim like or scattered manner. The diagnosis is confirmed by transthoracic needle biopsy/bronchial washings. The other organisms causing fungus ball are *Candida albicans*, *Pseudallescheria boydii*, *Coccidioides immitis*, *Nocardia*, and *Actinomyces*. Fungal ball when complicated by hemoptysis can be life-threatening.

Case 59

A 56 years old female came to radiology department for X-ray chest with history of mastectomy six months ago for carcinoma of right breast.

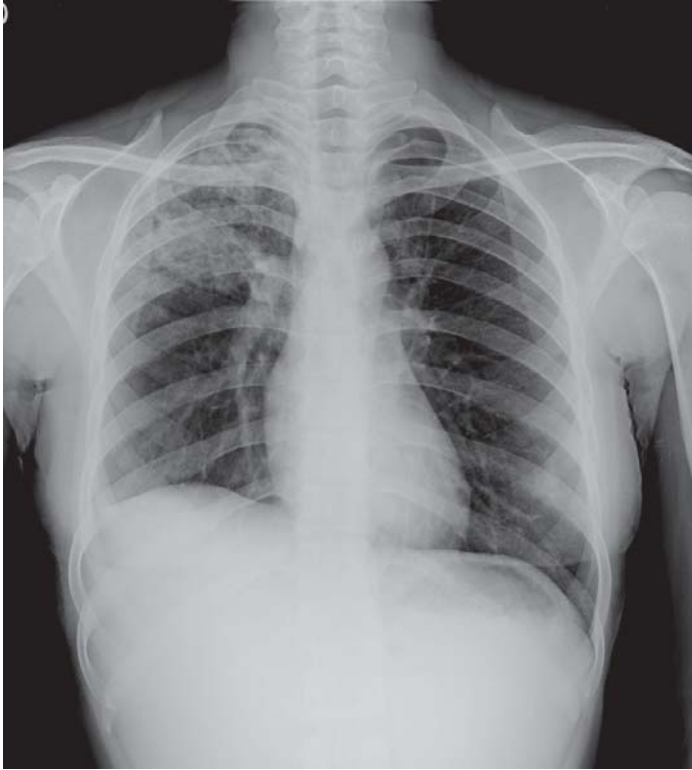


Fig. 5.59

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.59) shows non-homogeneous network of fibrosis involving essentially right upper zone with volume loss.

COMMENTS AND EXPLANATION

Conventionally, radiotherapy is given after the surgery for breast cancer to the region of the tumor bed and regional lymph nodes, to destroy any residual tumor cells. Radiation can also be given at the time of operation on the breast cancer-intraoperatively. Radiation can reduce the risk of recurrence by 60% and is considered essential when breast cancer is treated by lumpectomy with wide local excision.



Fig. 5.60

OPINION

Radiation fibrosis.

CLINICAL DISCUSSION

Following radiation therapy for breast or lung cancer, radiation pneumonitis may develop in the zone of radiation. Patient may be asymptomatic or may present with cough, dyspnea, mild fever, elevated erythrocyte sedimentation rate and leukocytosis. In the first few weeks there are ill-defined small shadows in the radiation field as a result of pneumonitis, which later progresses to pulmonary fibrosis in 6 to 12 months. There is loss of lung volume with radiation fibrosis (Fig. 5.60). Pulmonary fibrosis manifests as dense coarse shadowing with sharp margins in the radiation field with no respect to the usual lobar and segmental boundaries. The adjacent lung appears normal on chest radiographs. CT scan is helpful in confirming the diagnosis. Adjacent pleural thickening may be seen on CT scan. Treatment is with steroids. Follow up with chest radiographs is recommended in symptomatic patients.

Case 60

A 63 years old female came to radiology department for X-ray chest with history of cardiac surgery and complaints of having breathlessness on mild exertion.



Fig. 5.61

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 5.61) shows sternotomy wire sutures, changes in pulmonary hemodynamics in cardiac state with ensuing pulmonary edema involving the interstitial and alveolar spaces.

COMMENTS AND EXPLANATION

Chest X-ray shows change in pulmonary hemodynamics in cardiac pathology with ensuing pulmonary edema involving the interstitial and alveolar spaces.

Heart disease may result in alterations in pulmonary hemodynamics. Hence appearance of the lung fields is important in cardiac assessment. Left heart lesions lead to pulmonary venous hypertension resulting in back pressure on the lungs as seen in left ventricular failure or mitral disease. The typical features are diversion of blood to the upper zones from the lower zones of the lung in the erect X-ray chest PA view. In normal individuals the upper zone vessels appear smaller than those in the lower zone, but with pulmonary venous hypertension they become more prominent. As pressure rises, pulmonary edema builds up involving the interstitial or alveolar spaces or both. There is appearance of septal B lines at the costophrenic angles representing fluid in the interlobular tissue planes. Alveolar edema is often perihilar with blurring and haziness of the central areas lung and is referred as bat's wing shadows but may be more extensive, pleural effusion may also develop and may loculate, particularly in the fissures.

OPINION

Pulmonary interstitial edema.

CLINICAL DISCUSSION

Pulmonary edema is airspace disease and the signs include (i) shadow with ill-defined borders (ii) air bronchogram and (iii) silhouette sign. There are two distinct radiographic patterns of pulmonary edema: pulmonary alveolar edema and pulmonary interstitial edema. In the early stages of pulmonary edema the infiltrates and fluid collect in the interstitial tissue of lung parenchyma and in later stages involve the alveoli. The characteristic features of pulmonary interstitial edema are septal lines and thickening of pleural fissures.

Pulmonary wedge capillary pressure changes reflect the stages seen in pulmonary edema.

Normal pulmonary capillary wedge pressure (PCWP) is less than 15 mm Hg. At PCWP between 15–20 mm Hg, there is reversal and redistribution of blood flow in pulmonary vessels, upper lobe vessels appear prominent on chest radiographs.

At PCWP between 20–25 mm Hg, interstitial edema occurs leading to septal thickening and above 25 mm Hg, the alveoli are filled with fluid and nodular opacities seen on chest radiographs.

Septal lines are lung parenchymal connective tissues which contain the lymph vessels. In a normal chest radiograph these septal lines are invisible. Thickened pulmonary septa can be identified on chest radiographs. The two most important causes of septal lines are pulmonary edema and lymphangitis carcinomatosa.

Kerley A lines are septal lines which radiate towards the hilar region in mid and upper zones. They appear thinner than the adjacent blood vessels and do not reach the lung periphery on a chest PA radiograph.

Kerley B lines are horizontal septal lines seen at the periphery of lung and can reach the lung edge on a chest PA radiograph. They measure less than 2 cm in length.

Pleural fissure thickening: sometimes a loculated effusion may occur in pulmonary fissures which appear as thickened septa on chest radiograph.

Other features seen in pulmonary interstitial edema are mild enlargement of peribronchovascular spaces, subpleural effusions, progressive blurring of pulmonary vascular markings due to central migration of edema at lobar and hilar regions.

Causes of pulmonary edema:

- i. Cardiogenic pulmonary edema is seen in acute left ventricular failure, mitral stenosis, renal failure and overtransfusion of fluids.
- ii. Non-cardiogenic pulmonary edema is seen in acute respiratory distress syndrome (ARDS).

Treatment of cardiogenic pulmonary edema is by oxygen therapy and intravenous diuretics. Significant resolution is seen in the first 24 hours which helps it to distinguish from non-cardiogenic pulmonary edema.

Treatment of non-cardiogenic pulmonary edema is treatment of the underlying etiology like sepsis, CO poisoning, drowning, trauma, etc.

Case 61

A 60 years old male came to radiology department for X-ray chest with history of persistent cough.



Fig. 5.62

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.62) shows non-homogeneous shadowing and no air bronchogram involving both lung fields. There is abnormal whiteness in both lung fields.

COMMENTS AND EXPLANATIONS

The lungs are the most common target for metastatic disease. Most pulmonary metastases are nodular, but a significant minority is interstitial. Lymphangitis carcinomatosa (LC) refers to the diffuse infiltration and obstruction of pulmonary parenchymal lymphatic channels by tumor. On X-ray chest finding as mentioned above, one must think about causes of interstitial lung disease such as pulmonary fibrosis, pulmonary edema and lymphangitis carcinomatosa. The distribution of this shadowing gives important clues. It affects the upper, middle and lower lung zones and is central in its distribution. This would be unusual for fibrotic lung disease, which usually involves the lung periphery atypical of pulmonary edema. LC is seen in primary adenocarcinoma of breast, lung, pancreas, gastrointestinal tract and prostate.

OPINION

Lymphangitis carcinomatosa.

CLINICAL DISCUSSION

Lymphangitis carcinomatosa occurs due to tumor cell embolization of blood vessels followed by pulmonary lymphatic blockage, interstitial edema and collagen deposition may occur, in the end fibrosis ensues. The bronchovascular interstitium, interlobular septa and subpleural space can be involved. The location of the primary malignancy is usually lung, breast and abdomen. Patient may present with slowly increasing dyspnea over weeks and months. The chest radiograph signs can be interstitial thickening and alveolar infiltrates similar to pulmonary edema. The lymphatic vessels become distended leading to septal lines, peribronchial thickening, decreased lung volume and reticulonodular opacities. Hilar and mediastinal lymphadenopathy may be seen. Pleural effusion may occur. Usually lymphangitis carcinomatosa is bilateral; it can be unilateral in cases of direct involvement from ipsilateral lung malignancy. Cardiac shape and size is normal and helps to differentiate from cardiogenic pulmonary edema. High resolution computed tomography is helpful in confirming the diagnosis.

Treatment is symptomatic and treatment of the underlying malignancy with chemo-radiotherapy.

Case 62

A 32 years old male came to radiology department for X-ray chest with history of cough and breathlessness.

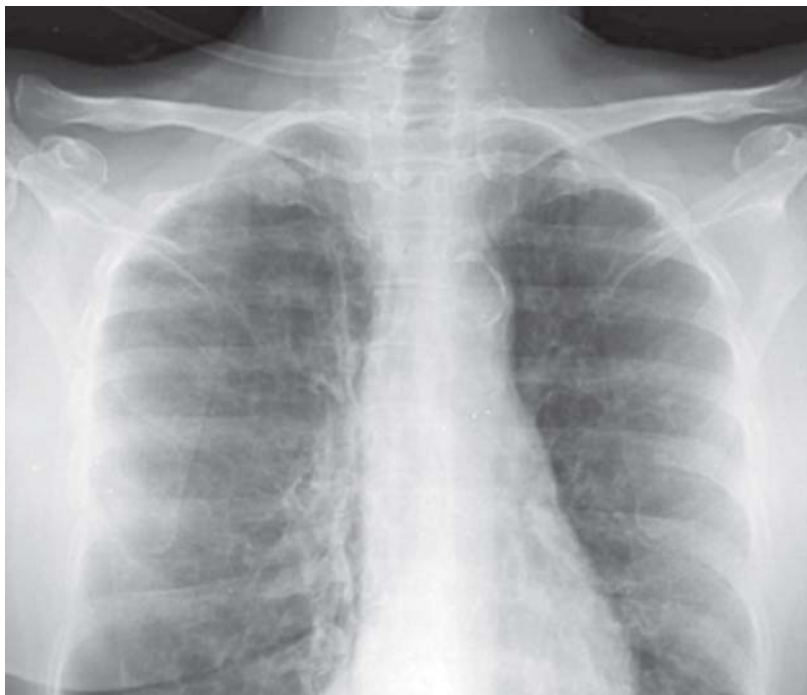


Fig. 5.63

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 5.63) shows emphysematous change in the lungs with aortic arch calcification. When emphysematous chest with no specific cause seen before the age 40, one should think of alpha-1 antitrypsin (AAT) deficiency.

COMMENTS AND EXPLANATION

Emphysematous lungs on chest X-ray without specific cause seen before age the 40, one is guided to a diagnosis of alpha-1 antitrypsin (AAT) deficiency.

Smoking can increase the risk of emphysema. Adults with severe deficiency will develop emphysema before the age of 40 years. The classical radiological features include emphysema in patient younger than 40 years with family history of emphysema.

OPINION

Alpha-1 antitrypsin (AAT) deficiency.

CLINICAL DISCUSSION

In alpha-1 antitrypsin (AAT) deficiency the body does not make enough of a protein that protects the lungs, liver and skin. AAT is a protein whose function is protease inhibitor. It is produced in liver. It is caused by a genetic defect. Alpha-1 antitrypsin deficiency in lungs predisposes the lung parenchyma to hyperinflation and destruction of the peripheral airways leading to emphysema. Smoking increases the risk of developing emphysema in AAT patients. Panlobular emphysema is the most common form of emphysema seen with Alpha-1 antitrypsin deficiency. Some radiological features on chest radiograph include increased lung volume and attenuation of the bronchovascular markings which appear as increased transradiancy.

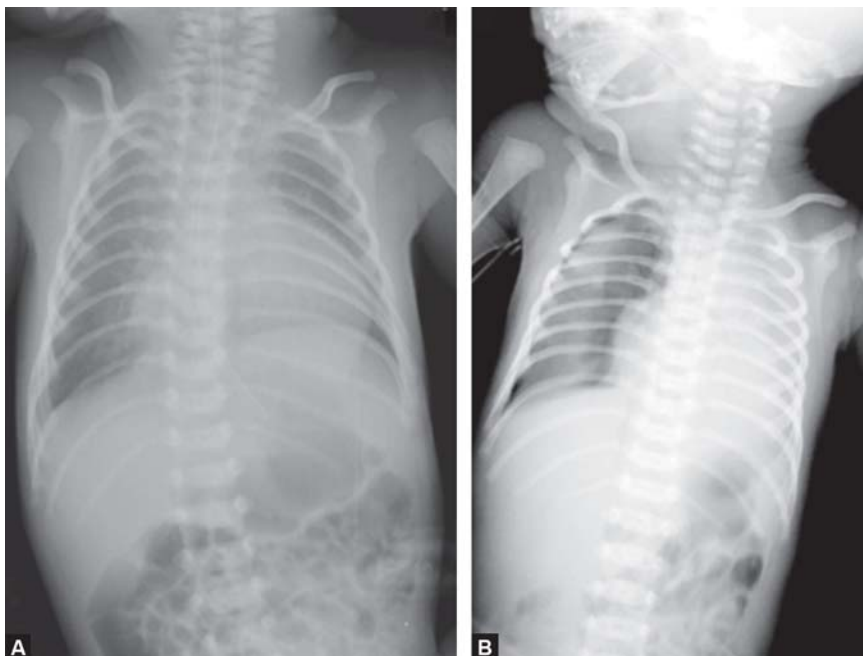
Destruction of the walls of the airspaces can produce a large bulla. Sometimes the bulla can rupture resulting in small pneumothorax.

High resolution CT scan of thorax can distinguish panlobular emphysema from other types of emphysema. Neonatal hepatitis, cirrhosis both in children and adults, and hepatocellular carcinoma is more frequent in AAT deficiency.

Treatment options include discontinuing smoking of tobacco, Alpha-1 antitrypsin therapy, bronchodilators, antibiotics, surgical intervention like bullectomy or lung transplant. Prognosis is poor in advanced stages.

Case 63

A premature newborn male was brought to radiology department for X-ray chest with history of low birth weight with respiratory distress.



Figs 5.64A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

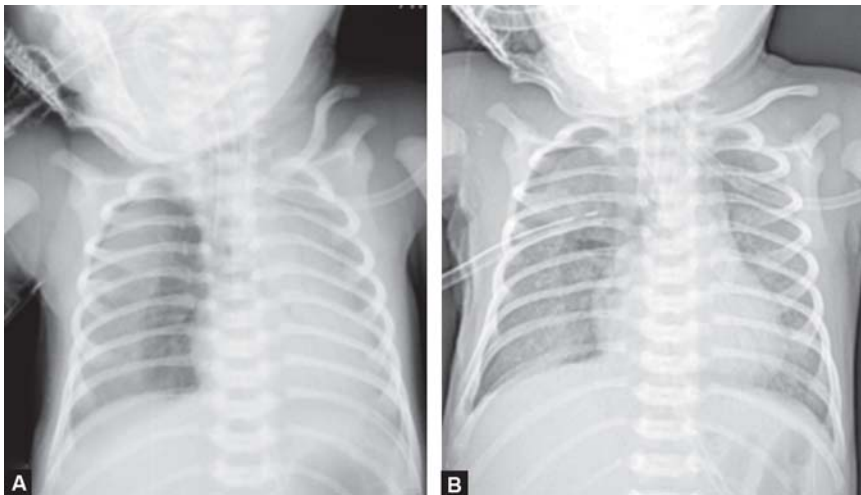
X-ray chest (Fig. 5.64A) of a premature newborn on Day 1 shows granular evenly distributed ground glass appearance of both lung fields. Neonate shows increased respiratory distress and X-ray shows development of right sided pneumothorax (Fig. 5.64B), left lung is more white than right. The findings suggest respiratory distress syndrome.

COMMENTS AND EXPLANATION

X-ray chest was repeated on Day 2 after being subjected to surfactant and intubated, pneumothorax persisted (Fig. 5.65A). Newborn was subjected to intercostal drainage. This resulted in clinical and radiological improvement with X-ray showing aeration of lungs and reduction in pneumothorax (Fig. 5.65B).

Respiratory distress syndrome (RDS or hyaline membrane disease) is the result of anatomic pulmonary immaturity and deficiency of surfactant.

Infants with respiratory distress syndrome have all clinical signs of respiratory distress. The clinical presentation of expiratory rumbling (due to partial closure of glottis), tachypnea, intercostal retraction, nasal flaring, and cyanosis manifest in first few hours and almost always within 8 hours of age. If symptoms do not develop until after 8 hours of normal breathing, RDS is excluded. On auscultation, air movement is diminished despite vigorous respiratory effort.



Figs 5.65A and B

OPINION

Respiratory distress syndrome.

CLINICAL DISCUSSION

The important causes of respiratory distress in a newborn include RDS, meconium aspiration and transient tachypnea of newborn. RDS of neonates is a condition affecting premature neonate. Surfactant deficiency causes the alveoli to collapse thus preventing gas exchange in lungs. Pulmonary surfactant decreases surface tension in the alveolus during expiration, allowing the alveolus to remain partly expanded, thus maintaining the functional capacity. Surfactant is produced by type II pneumocytes in alveoli. Pulmonary surfactant synthesis begins at 24–28 weeks of gestation and gradually increases until full gestation. On chest radiographs small pulmonary opacities and air bronchograms are seen in both lungs fields. In mild cases on chest radiographs small pulmonary nodules with air bronchograms are seen. In severe cases on chest radiographs the pulmonary opacities are more widespread and the lungs appear white with air bronchograms. In premature infants, absence of surfactant results in poor pulmonary compliance, atelectasis, decreased gas exchange, severe hypoxia and acidosis. Treatment is by oxygen support, mechanical ventilation and surfactant aerosol therapy.

Meconium aspiration causes respiratory distress in the neonate. The neonate may be preterm, full-term or post-term. It occurs when the fetus had aspirated thick meconium into the respiratory tract. On chest radiographs there are patchy and streaky types of pulmonary shadowing. Air bronchograms are not a dominant feature of meconium aspiration. The domes of diaphragm are lower in position due to the blockage of airways with sticky meconium plugs. Treatment of meconium aspiration is suction of upper airway using laryngoscope for thick meconium plugs, oxygen support and antibiotics.

Transient tachypnea of newborn is a condition more common in neonates who are delivered through cesarean section. The condition causes mild respiratory distress that resolves in 48 hours normally. Treatment of transient tachypnea of newborn is oxygen support.

Case 64

A 59 years old patient came to radiology department for X-ray chest with history of difficulty in breathing and loss of appetite.

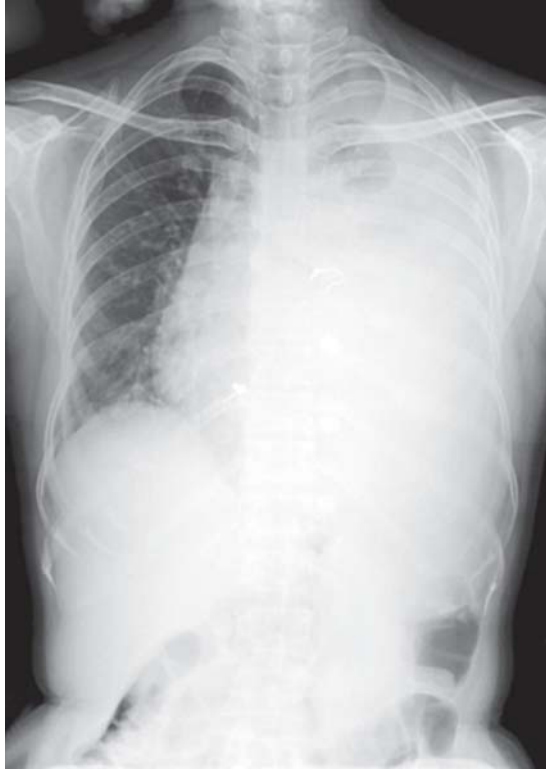


Fig. 5.66

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest shows opaque left hemithorax with no air bronchogram. Trachea and mediastinum are pushed to the right, due to massive pleural effusion and collapse of left lung. A small area at and below the level of clavicle is the only poorly aerated part of left lung which can be seen. On further evaluation it can be appreciated that the left dome of diaphragm is pushed well below to its normal position (Fig. 5.66), to the extent that its superior margin has become concave upwards instead of being convex normally. This is due to extensive collection of pleural fluid. CT chest was advised.

COMMENTS AND EXPLANATION

CT chest was performed which confirmed X-ray chest findings on coronal reconstruction, which provides additional information of mass in the left lung with metastasis in the liver (Fig. 5.67). This aids to make a diagnosis of carcinoma lung with malignant pleural effusion and hepatic metastasis. The weight of a large effusion has caused inversion of the diaphragm, and this sign is probably best demonstrated by ultrasound. One must always remember to glance through the rest of the film to look for the cause of the effusion.

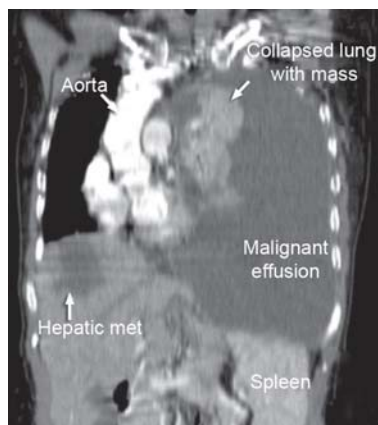


Fig. 5.67

OPINION

Carcinoma lung with malignant pleural effusion and hepatic metastasis.

CLINICAL DISCUSSION

Lung cancer is one of the common primary tumors in both men and women. Some subtypes of lung cancer are related to smoking tobacco.

Symptoms include chronic cough, dyspnea, weight loss, hemoptysis, loss of appetite, pathological bone fractures. Lung cancer for descriptive purposes is divided according to their location in lung parenchyma as central tumors and peripheral tumors. The central tumors can present as hilar mass, narrowing of the adjacent major bronchus with collapse or consolidation beyond the tumor. The peripheral tumors can present as a solitary pulmonary mass with irregular borders and infiltrating patterns and cavitation within the lung mass. The histologic subtypes of lung cancer are small cell lung cancer, non small cell lung cancers (squamous cell, large cell and adenocarcinoma). Adenocarcinomas are not related to smoking. The spread is by local direct spread involving the adjacent lung parenchyma and bronchial structures, hematogenous dissemination causes distant emboli, lymphatic spread results in lymphangitis carcinomatosa. Invasion of the chest wall may also occur. Metastasis may develop in the ribs causing lytic lesions, pulmonary metastasis present as rounded pulmonary nodules. Pleural metastasis present as bloody effusions. Treatment is chemotherapy and radiotherapy. Surgical resection is curative in early stages and palliative in advanced stages. Liver metastasis indicates poor prognosis.

Case 65

A 52 years old male, known alcoholic and smoker for past 30 years came to radiology department for X-ray chest with history of cough, expectoration and hemoptysis for past 6 months.

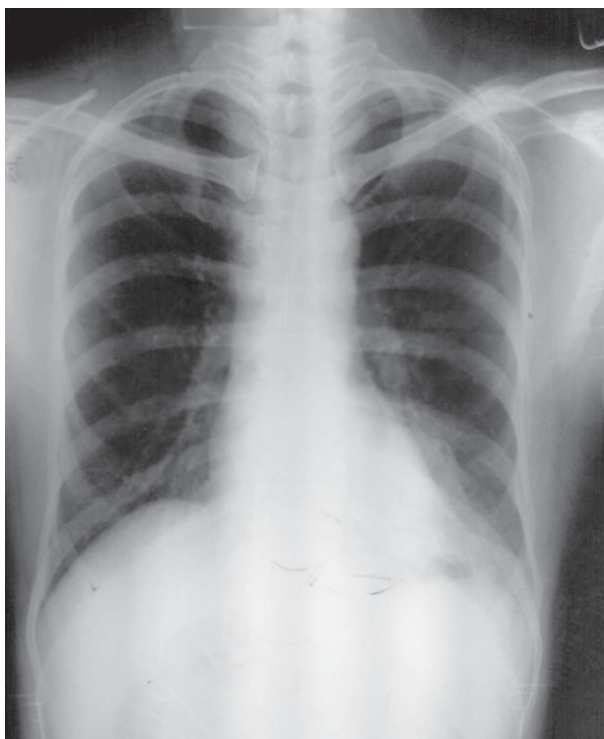


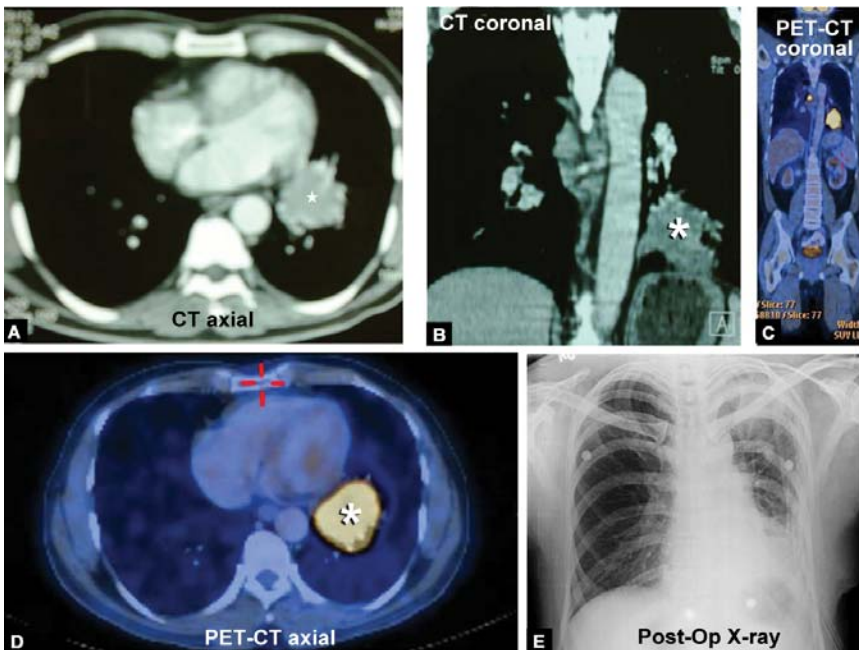
Fig. 5.68

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 5.68) shows a soft tissue mass lesion which appears underlying the heart shadow in left lower zone of which the margins seen are not smooth. In view of age and history of long period of smoking, findings suggestive are of bronchogenic carcinoma subject to confirmation on CT chest.

COMMENTS AND EXPLANATION

The patient was subjected to CT chest (Figs 5.69A and B) which confirmed a showed a solid mass in posterior basal segment of left lower lobe. Videobronchoscopy with brush biopsy detected a fleshy growth which bled profusely suggestive of neoplastic etiology. PET-CT scan showed large heterogeneous metabolically active mass lesion in left lung lower lobe suggestive of primary lung carcinoma (Figs 5.69C to E). Left lower lobe lobectomy was done. Histopathology confirmed the suspicion of X-ray chest.



Figs 5.69A to E

OPINION

Bronchogenic carcinoma lung.

CLINICAL DISCUSSION

Mass lesion seen in the lung after the age of 40 years should be considered malignant unless proved otherwise more so in males and chronic smokers.

Thymus and Mediastinal Nodes

Chapter

6

Amol Nade

Case 66

A 5 years old child came to radiology department for X-ray chest with history of cough and cold.

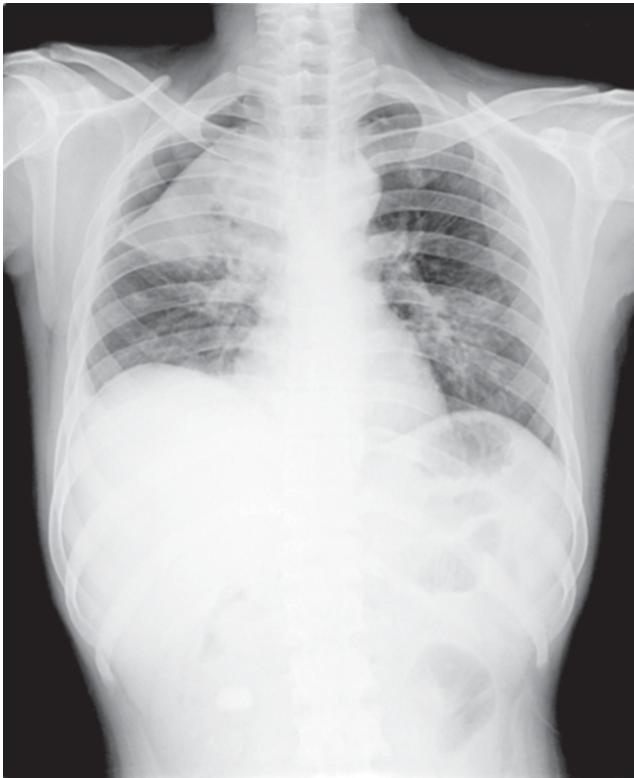


Fig. 6.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 6.1) shows non-homogeneous shadow due to consolidation in left lower zone of lung. A sail shaped projection is seen on right side of mediastinum extending into right lung.

COMMENTS AND EXPLANATION

Sail shaped projection on right side of mediastinum is due to normal thymus gland. Normal thymus is of soft consistency and weighs 10–15 gm but can go up to 35 gm. It is extremely variable in size and appearance during early life. The thymus occupies the anterior and superior mediastinum, located behind the sternum in the midline. In children, normal thymus may present as an anterior mediastinal mass but should not be misinterpreted as a germ cell tumor, teratoma, lymphoma or tubercular adenopathy which are important causes of anterior mediastinal mass. On X-ray chest in children it appears as a sail shaped projection generally on right side of mediastinum but may be present on left side or both sides. It may have a wave like lateral margin. Thymus plays a crucial role in the development of immunity.

OPINION

X-ray chest shows left lower zone consolidation with thymus. Thymus is normal in appearance.

CLINICAL DISCUSSION

Normal thymus appears in a variety of shapes and sizes. It gradually involutes with age. It may acutely shrink during periods of bodily stress and grows back to its original size or even larger, this phenomenon is known as thymic rebound hyperplasia. Familiarity with the embryology, anatomy, and dynamic physiology of the thymus is essential to avoid unnecessary imaging or invasive procedures. Radiologists play a major role in differentiating normal thymic variants, ectopic thymic tissue, and non-neoplastic thymic conditions such as rebound hyperplasia from neoplastic conditions. Knowledge of the imaging findings of thymic tumors and their mimics may help radiologists arrive at the correct diagnosis.

Case 67

A 65 years old female came to radiology department for X-ray chest with history of weight loss over last for 6 months.



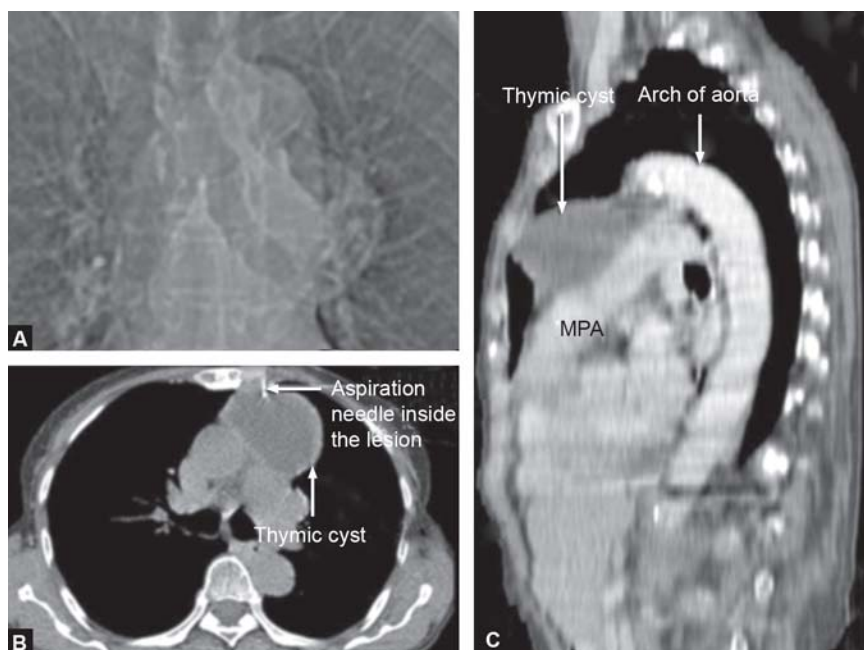
Fig. 6.2

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 6.2) shows clear lung fields with left perihilar rounded opacity.

COMMENTS AND EXPLANATION

To confirm the nature of left perihilar rounded opacity the patient was subjected to CT chest (Figs 6.3A to C) which shows a 4×5 cm well-defined unilocular cystic lesion (CT value 16 HU) in anterior mediastinum in the region of thymus on left side. Lesion shows thin enhancing wall suggestive of thymic cyst. No evidence of calcification seen. No evidence of mediastinal or hilar adenopathy. CT guided aspiration was done and 5 cc of brownish fluid (suggesting some hemorrhage) was aspirated and diagnosis of thymic cyst confirmed.



Figs 6.3A to C

OPINION

Thymic cyst.

CLINICAL DISCUSSION

Thymic tumors occupy the anterior mediastinum, immediately posterior to the sternum and the anterior surface of the pericardium and great vessels. Other tumors of anterior mediastinum are thymic, lymphatic, or germ cell tumors.

About one half of all thymic tumors are malignant at the age of 20–40 years. CT is most valuable imaging modality in the diagnosis of thymic lesions and anterior mediastinal masses. Magnetic resonance imaging (MRI) may be used.

Approximately two thirds of all mediastinal tumors and cysts are symptomatic in children, whereas only one third are symptomatic in adults. On CT scans, a thymic cyst appears homogeneous with water attenuation. The attenuation may vary, depending on the contents of the cyst. High attenuation may be present if the cyst contains proteinaceous fluid. A neoplasm with cystic degeneration may closely mimic a thymic cyst; associated soft tissue attenuation may help in their differentiation.

Case 68

A 13 years old child was brought to radiology department for X-ray chest with history of cough of 2 weeks duration.

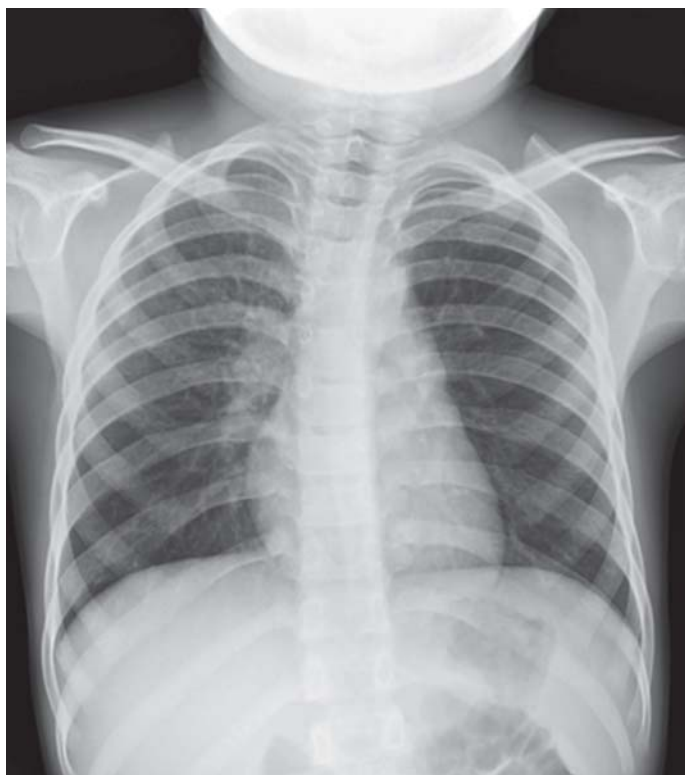


Fig. 6.4

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 6.4) shows prominence of right hilum which is convex; on closer look it shows a lobulated enlarged lymph nodes.

COMMENTS AND EXPLANATION

Right hilum being prominent and convex, on magnified view (Fig. 6.5) shows it as lobulated enlarged lymph nodes, which were confirmed to be of tuberculous etiology.

Normal hilar lymph nodes cannot be identified on plain chest X-ray. In hilar adenopathy, usually more than one lymph node is enlarged and it is present on chest X-ray as a hilar mass with lobulated margins.

Fine needle aspiration cytology of the hilar lymph nodes is done to confirm the diagnosis. Remember to look for any associated lung pathology which will give the clue to diagnosis. On CT scan, normal lymph nodes are usually less than 1 cm in long axis, enlarged lymph nodes are clearly seen on CT scan and they normally show some postcontrast enhancement. Tuberculosis is the most important cause of unilateral hilar adenopathy in children.



Fig. 6.5

OPINION

Hilar adenopathy.

CLINICAL DISCUSSION

Unilateral hilar enlargement is most commonly due to adenopathy seen with infections such as tuberculosis and in neoplasm and vascular dilatation. Nodes affected by lymphoma are often asymmetrical. Other infective causes are histoplasmosis, coccidiomycosis, mycoplasma and pertussis. Bilateral hilar adenopathy is seen in sarcoidosis and lymphoma. False positive bilateral hilar adenopathy is seen in pulmonary hypertension.

Case 69

A 55 years old male came to radiology department for X-ray chest with symptoms of fatigue, lack of energy and weight loss.



Fig. 6.6

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 6.6) shows clear lung fields with multiple bilateral symmetrically enlarged hilar lymph nodes showing peripheral or egg shell calcification, suggesting diagnosis of sarcoidosis.

COMMENTS AND EXPLANATION

Sarcoidosis commonly develops thoracic lymphadenopathy and parenchymal lung opacities. Adenopathy almost always precedes pulmonary shadowing, but they are often present simultaneously. The chest radiograph is abnormal at some time in 90% of patients with sarcoidosis. In sarcoidosis there is bilateral symmetrical hilar enlargement involving both tracheobronchial and bronchopulmonary nodes. Bilateral hilar adenopathy in the correct clinical setting is considered as sufficient evidence of sarcoidosis and negate the need of biopsy.

OPINION

Sarcoidosis.

CLINICAL DISCUSSION

Enlargement of other mediastinal nodes are rarely appreciated on the chest radiograph but may be seen on CT. If the hilar adenopathy is very asymmetrical or anterior mediastinal adenopathy is present alternative diagnosis should be considered. The involved lymph nodes may undergo calcification, when this calcification is in the periphery it is referred as egg-shell calcification as seen in this case.

Other causes of bilateral hilar lymphadenopathy include: (1) Infections like tuberculosis, mycoplasma, Whipple's disease (2) Lymphoma, carcinoma, mediastinal tumors (3) Organic dust diseases like silicosis, berylliosis (4) Extrinsic allergic alveolitis like bird fancier's disease (5) Less common causes like Churg-Strauss syndrome, human immunodeficiency virus, extrinsic allergic alveolitis, pneumoconiosis, adult onset Still's disease.

Sikandar Shaikh

Case 70

A 7 years old child was brought to radiology department for X-ray chest with history of cough and loss of appetite.

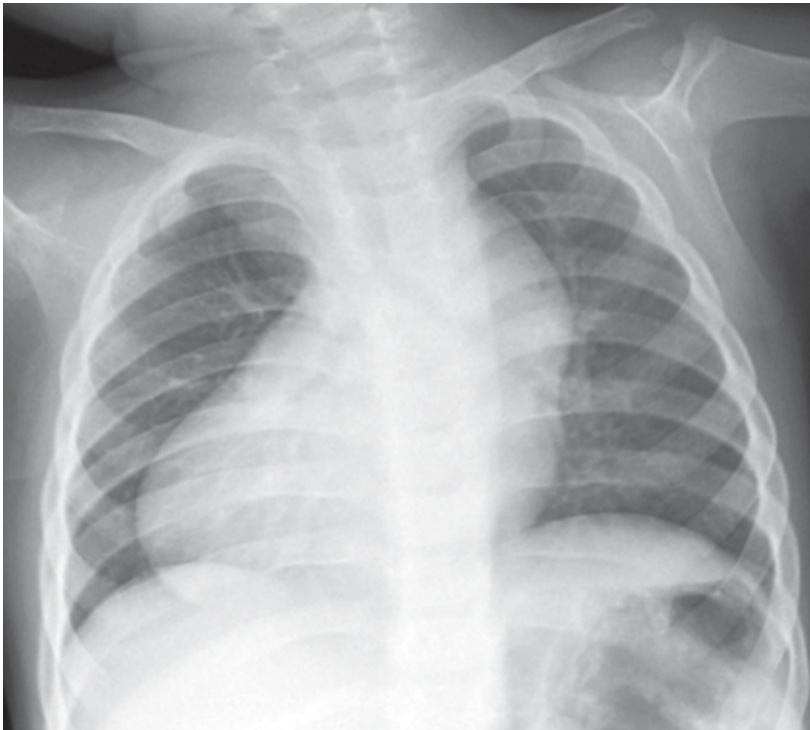


Fig. 7.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 7.1) shows apex of heart lying on right side of chest (dextrocardia), the liver, spleen and gastric air bubble are in their normal anatomic position.

COMMENTS AND EXPLANATION

In dextrocardia, the heart is located onto the right side of the chest; in this the axis of heart is maintained and is considered to be due to embryonic arrest. It is diagnosed on chest X-ray. It may be an isolated dextrocardia or dextrocardia situs inversus totalis. The isolated dextrocardia may be associated with cardiac abnormality like pulmonary hypoplasia. In dextrocardia of situs inversus the heart is mirror image with the axis of heart to the right side. It is free from congenital cardiac defects but may be associated with bowel, bladder, esophageal and bronchial pathologies. It may be associated with Kartagener's syndrome.

OPINION

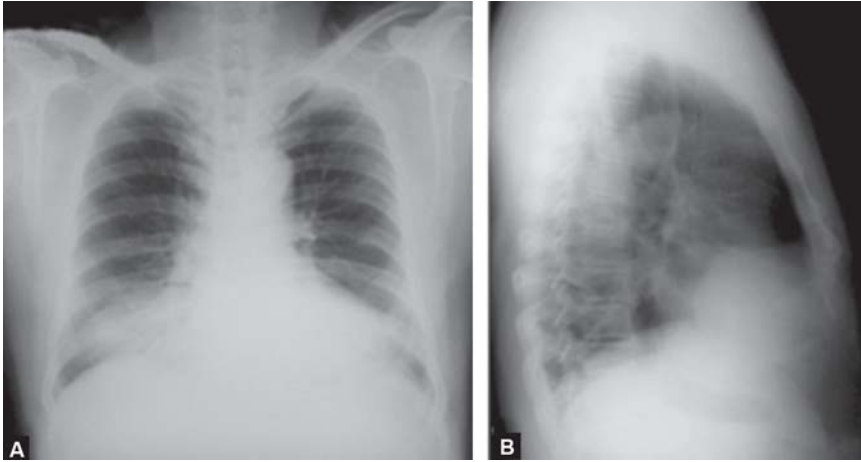
Dextrocardia.

CLINICAL DISCUSSION

In dextrocardia the malposition is intrinsic to the heart and not caused by extracardiac abnormalities. Dextrocardia should be differentiated from cardiac dextroposition, which is defined as displacement of the heart to the right secondary to extracardiac causes such as right lung hypoplasia, right pneumonectomy, or diaphragmatic hernia. Although dextrocardia in infants can be associated with many cardiac anomalies, dextrocardia in adults has a limited range of diagnostic possibilities. As a result of advances in CT, radiologists are interpreting an increasing number of cardiac imaging studies and will encounter cases of cardiac malposition. Although situs inversus totalis is easily recognizable, clinician should also be familiar with the more unusual causes of dextrocardia.

Case 71

A 20 years old male came to radiology department for X-ray chest for medical examination.



Figs 7.2A and B

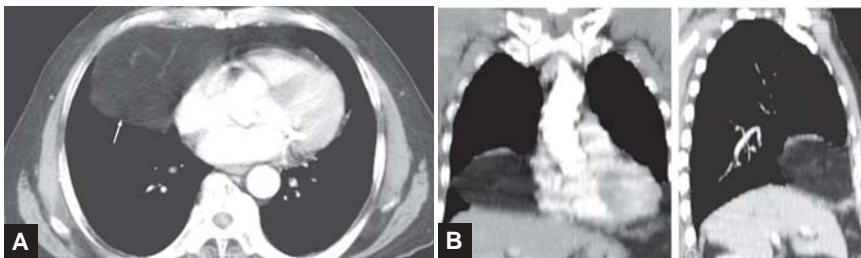
RADIOLOGICAL FINDINGS

X-ray chest PA and lateral views (Figs 7.2A and B) show a radio-opaque mass lesion anteriorly in right cardiophrenic angle.

COMMENTS AND EXPLANATION

CECT (Figs 7.3A and B) was performed, it shows a well-defined mass lesion having average CT value of $(-)$ 89 HU confirming fat pad anteriorly in right cardiophrenic angle is pericardial in position. Reconstructed coronal and sagittal CT confirm the X-ray finding and confirm the lesion to be epicardial lipoma because of the CT density of the mass lesion.

In this case the average density within the region of interest is $(-)$ 89 HU. There is no differential diagnosis once the CT examination is performed, however, thymoma is considered for discussion. The density of the thymus is about 45 HU in children and young adults. The density of the organ decreases with age from the third decade onward. As result of involution, it becomes fatty and finally the density is that of fat (-90 to -150 HU).



Figs 7.3A and B

OPINION

Epicardial fat-pad or epicardial lipoma.

CLINICAL DISCUSSION

Epicardial fat-pad or epicardial lipoma is the most common cause of right cardiophrenic-angle mass. It is a triangular opacity in cardiophrenic angle is less dense than heart and increases in size under corticosteroid treatment. CT densitometry is helpful in confirming the diagnosis.

Other possible causes of right cardiophrenic-angle mass could be aneurysm of cardiac ventricle, dilated right atrium, pericardial cyst, diaphragmatic hernia of Morgagni, primary lung mass, enlarged lymph node of lymphoma or metastasis.

Case 72

One year old child was brought to radiology department for X-ray chest with history of episodes of cyanosis after exertion lasting for few minutes.



Fig. 7.4

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest of one year old child (Fig. 7.4) shows a boot-shaped heart and was diagnosed as a case of tetralogy of Fallot.

COMMENTS AND EXPLANATION

On chest X-ray the right ventricular hypertrophy is seen as elevated left ventricle. Combined with a small or absent main pulmonary artery segment, the heart shows the classic boot-shaped appearance. Vascularity of the pulmonary artery is reduced. A right-sided arch is present in 25% of cases.

Echocardiography is the primary imaging method in suspected cases. Echocardiography should be used to confirm radiographic findings that are suggestive of tetralogy of Fallot. Intracardiac anomalies, including pulmonary infundibular and valvular stenosis and the position of the aortic root overriding and the ventricular septal defect are identified.

CT is useful for the evaluation of surgical complications such as infection or pseudo-aneurysm formation and to identify airway compression that is caused by a large ascending aorta that is associated with tetralogy of Fallot and MRI can be used to identify the morphologic abnormalities.

OPINION

Tetralogy of Fallot.

CLINICAL DISCUSSION

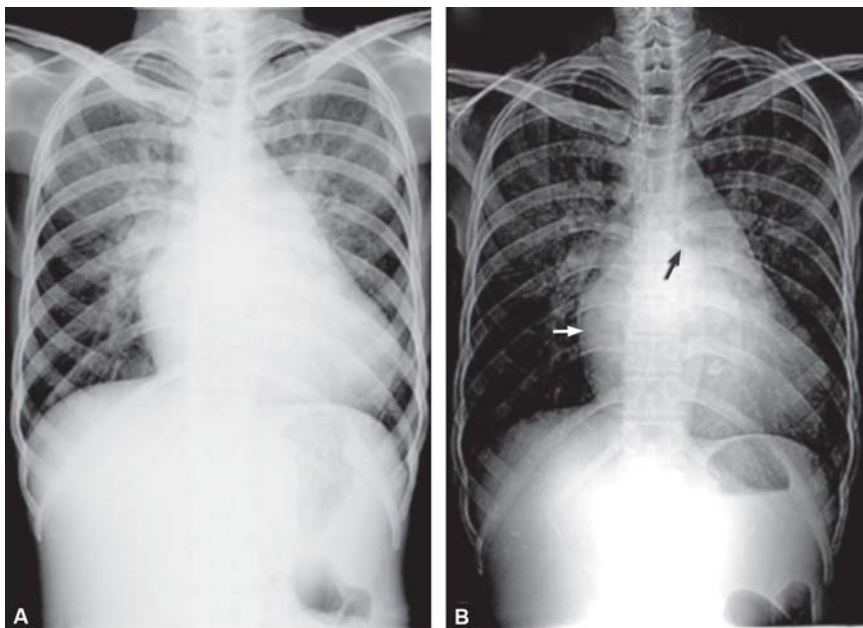
Louis Arthur Fallot, after whom the name tetralogy of Fallot is derived, was not the first person to recognize the condition. Stensen first described it in 1672; however, it was Fallot who first accurately described the clinical and complete pathologic features of the defects.

Most infants with tetralogy of Fallot develop cyanosis in the first year of life. The lips and mucous membrane inside the mouth and nose develop a dusky blue color. Infants with very severe obstruction of the right ventricle outflow tract are blue at birth. Cardiac catheterization and angiography is often required in addition to echocardiography because precise assessment of anatomy is essential in surgical planning.

Tetralogy of Fallot (TOF) is one of the most common congenital heart disorders (CHDs). This condition is classified as a cyanotic heart disorder, because tetralogy of Fallot results in an inadequate flow of blood to the lungs for oxygenation (right-to-left shunt).

Case 73

A 35 years old male came to radiology department for X-ray chest with history of breathlessness, cough and fever.



Figs 7.5A and B

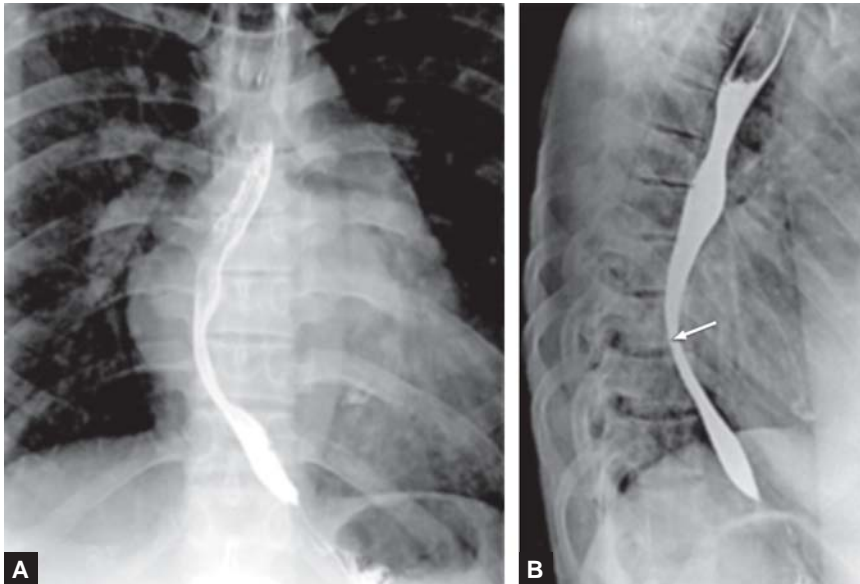
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Figs 7.5A and B) shows a double density due to enlarged left atrium (white arrow) better appreciated in penetrated view (Fig. 7.5B). There is increased carinal angle (black arrow). Normal carinal angle is 40° – 65° . The left heart border is straightened. There is prominence of upper lobe vessels in the lungs as appreciated by increased density in upper lobes. The case was diagnosed as mitral stenosis.

COMMENTS AND EXPLANATION

Barium swallow (Figs 7.6A and B) was done; it shows C-shaped extrinsic impression on the esophagus pushing it to the right and posteriorly (arrow) due to enlarged left atrium. Mitral stenosis (MS) results in the reduction of blood flow across the mitral valve due to fusion of leaflet commissures. The most common cause of MS is rheumatic fever. Chest radiograph provides useful information about the cardiac size, pulmonary vasculature, arterial and venous hypertension and secondary changes in the lung. Cardiac size may be normal.

The hallmark of MS is selective mild to moderate left atrial (LA) enlargement which results in straightening of the left heart border to a large bulge immediately below the left main bronchus. Secondary signs of LA enlargement are upward displacement of left main bronchus resulting in widening of carinal angle (Figs 7.5A and B) and deviation of the middle third of descending thoracic aorta to the left (Bedford sign).



Figs 7.6A and B

2D echocardiography identifies and quantifies the severity of stenotic valve lesion and valve morphology. Doppler helps to assess the trans-stenotic pressure gradient.

OPINION

Mitral stenosis.

CLINICAL DISCUSSION

Mitral stenosis refers to stenosis of mitral valve which fails to open fully restricting the blood flow resulting in diminished blood flow to the body.

Calcification of mitral valve if seen suggests rheumatic etiology. Hemodynamic changes in the pulmonary circulation are sensitive indicators of the severity of the disease displayed as prominence of upper lobe vessels, diminution of lower lobe vessels (Fig. 7.5). Kerley B lines and pleural effusion suggest pulmonary venous hypertension.

Enlargement of the main and branch pulmonary arteries indicate pulmonary arterial hypertension. Double right heart border is due to enlargement of left atrium. Hemosiderosis and ossific pulmonary nodules are noted in chronic long-standing cases. Esophagus is pushed posteriorly and to the right (Fig. 7.6) due to enlarged left atrium.

Case 74

A 12 years old child was brought to the radiological department with history of dyspnea and failure to thrive for X-ray chest.



Fig. 7.7

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 7.7) shows cardiomegaly and increased pulmonary vascularity. Aorta appears small with normal aortic knob. Hilar dance on fluoroscopy is due to increased pulsations of central pulmonary arteries, suggesting left-to-right (L-R) shunt. Multiple black and white spots seen are due to development of fungus on an old aged film

COMMENTS AND EXPLANATION

Chest X-ray is usually normal if the shunt is small. In cases of large shunt cardiomegaly and increased pulmonary vascularity is seen. Aorta appears small with normal aortic knob. Hilar dance is due to increased pulsations of central pulmonary arteries.

2D ECHO is diagnostic and shows paradoxical motion of interventricular septum due to volume overload of RV, interatrial septum is not visualized. Color Doppler study helps to determine presence and direction of blood flow from interatrial septum crossing LA to RA to RV.

OPINION

Left-to-right shunt.

CLINICAL DISCUSSION

L-R shunt is when blood from the left side of the heart goes to the right side of the heart. This can occur either through a hole in the ventricular or atrial septum or through a hole in the walls of the great vessels leaving the heart. Hence L-R shunt occurs when oxygen-rich pulmonary venous blood entering the left atrium is shunted to the right side of the ventricle to be ejected into the pulmonary artery. Left to right shunts include atrial septal defect (ASD), ventricular septal defect (VSD), patent ductus arteriosus (PDA), and patent foramen ovale.

Types of septal defect (L to R shunt):

1. Atrial Septal Defect (ASD)

Atrial septal defect is the most common congenital heart disease diagnosed in adults. It is classified into four types:

- i. Ostium secundum ASD is exaggerated resorptive process of septum primum
- ii. Ostium primum ASD is defect in atrioventricular endocardial cushions
- iii. Sinus venosus defect is in superior inlet portion of the atrial septum
- iv. Coronary sinus defect is due to absence of normal coronary sinus.

2. *Ventricular Septal Defect (VSD)*

VSD is a left to right shunt (L to R shunt) and is most common acyanotic heart disease in children. During embryological development single ventricular chamber divides into two by fusion of membranous portion of ventricular septum with endocardial cushions and bulbous cordis. It usually manifests after birth when pulmonary pressure decreases and systemic arterial pressure increases with development of L to R shunt. X-ray chest shows variable appearance depending on the size of the defect. It shows cardiomegaly with enlargement of left atrium, left ventricle and right ventricle. Pulmonary artery segment appears enlarged with increased pulmonary vascularity. 2D ECHO helps to identify and classify the VSD. Pressure gradient across the defect can be determined. Cross-sectional imaging CT and MRI are helpful in complicated cases to detect associated vascular anomalies and preoperative planning.

Case 75

A 22 years old male patient came to radiology department for X-ray chest with history of breathlessness and exertion.



Fig. 7.8

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On chest X-ray (Fig. 7.8), the heart appears as a globular enlargement giving a water bottle heart or flask shaped configuration suggesting the diagnosis of pericardial effusion.

COMMENTS AND EXPLANATION

CT chest (Fig. 7.9) was done; it shows pericardial effusion as a fluid attenuation area around the heart (arrow) within the layers of pericardium.

On chest X-ray very small pericardial effusion may not be evident on plain film but when large enough it presents like “water-bottle heart” in which the cardiopericardial silhouette is enlarged and assumes the shape of a water bottle or flask. USG is diagnostic as it shows fluid between the visceral and parietal layers of pericardium. Volume of fluid can be estimated. USG can be used as a therapeutic modality to aspirate the pericardial fluid.

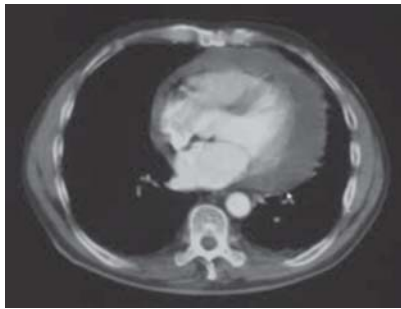


Fig. 7.9

OPINION

Pericardial effusion.

CLINICAL DISCUSSION

Patient of pericardial effusion presents with chest pain, breathlessness, and dyspnea on exertion. A small effusion may be asymptomatic.

Pericardial sac normally contains 15 to 50 ml of pericardial fluid. Pericardial effusion is an abnormal accumulation of fluid in the pericardial cavity. Excessive fluid accumulation leads to increased intrapericardial pressure and when there is enough pressure to adversely affect heart function, it is called cardiac tamponade. Pericardial effusion usually results from a disturbed equilibrium between the production and re-absorption of pericardial fluid, or from a structural abnormality that allows fluid to enter the pericardial cavity.

Types of pericardial effusion are:

- a. Transudative (congestive heart failure, myxoedema, nephrotic syndrome).
- b. Exudative (tuberculosis, spread from empyema)
- c. Hemorrhagic (trauma, rupture of aneurysms, malignant effusion).
- d. Malignant (due to fluid accumulation caused by metastasis).

Case 76

A 28 years old male patient came to radiology department for X-ray chest with history of insidious weight loss and exercise intolerance.

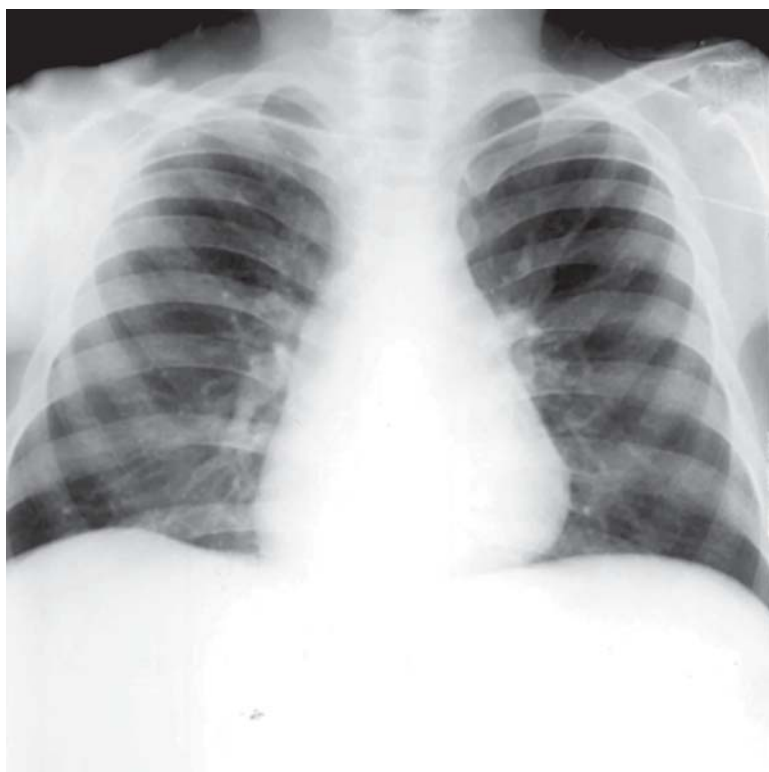


Fig. 7.10

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 7.10) shows sharp cardiac margin with straightening of right heart border with roughening of cardiac outline a result of pleuropericardial thickening in constrictive pericarditis.

COMMENTS AND EXPLANATION

Constrictive pericarditis (CP) is stiffening or reduction in the elasticity of the pericardium, resulting in impaired filling of the heart. The symptoms of CP include exercise intolerance, dyspnea, hepatic and renal failure, it appears insidiously. Imaging findings of calcifications and thickening of the pericardium may be present, but the reliable and important findings are related to the filling pattern of the heart. Patients respond dramatically to a complete surgical pericardiectomy when it is performed early in the disease process; therefore, it is important to consider CP when making the diagnosis.

OPINION

Constrictive pericarditis.

CLINICAL DISCUSSION

Constrictive pericarditis has symptoms that overlap a variety of diseases like myocardial infarction, aortic dissection, pneumonia, influenza, and connective tissue disorders. This overlap confuses the most skilled clinicians. Only a high degree of suspicion provides correct diagnosis followed by timely therapy.

In constrictive pericarditis thickened fibrotic pericardium impedes normal diastolic filling. Acute and subacute forms of pericarditis which may or may not be symptomatic deposit fibrin which may result in pericardial effusion leading to pericardial organization, chronic fibrotic scarring and restricted cardiac fill.

Constrictive pericarditis is a mystery and remains a diagnostic challenge to this day.

Case 77

A 55 years old male came to radiology department for X-ray chest for a follow up review after heart surgery.

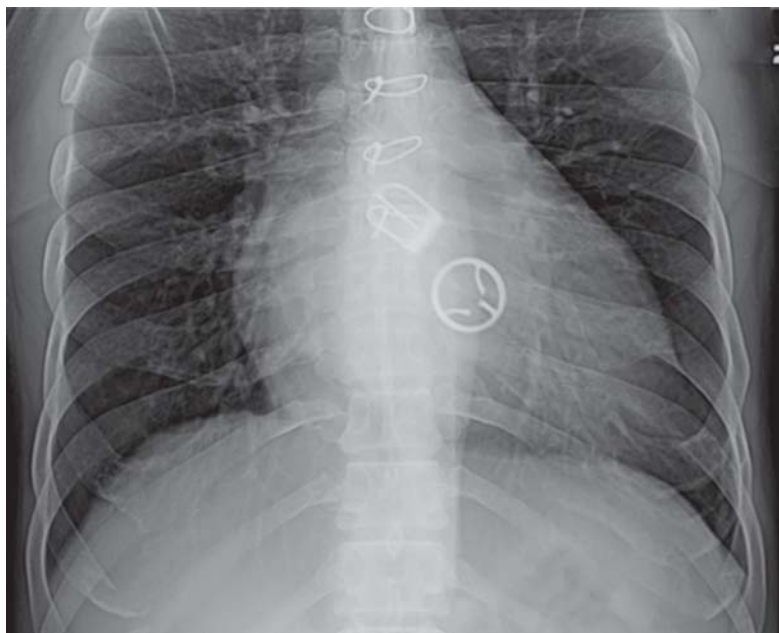


Fig. 7.11

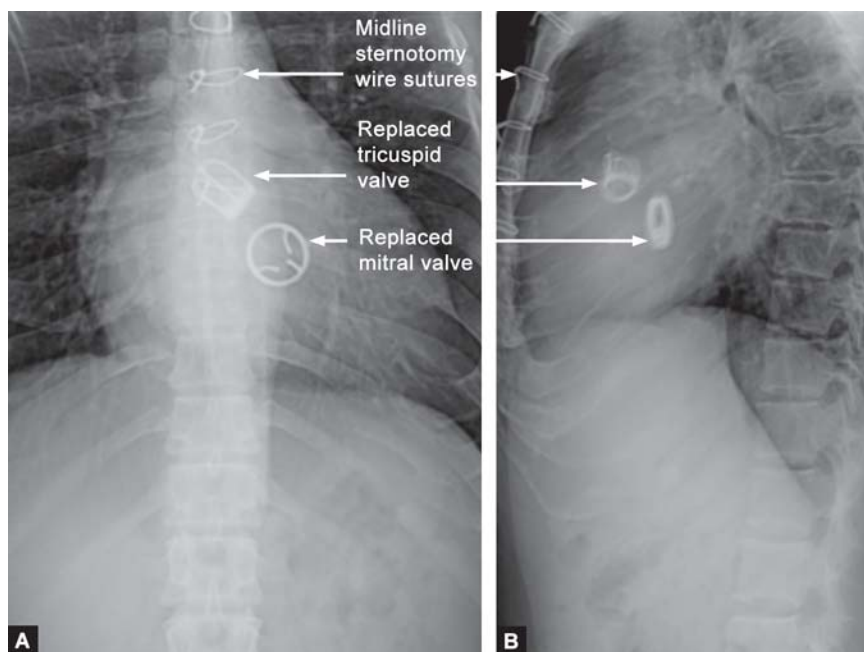
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 7.11) shows evidence of cardiac surgery from presence of midline sternotomy wire sutures. Metallic mitral and tricuspid valve replacement is seen.

COMMENTS AND EXPLANATION

In mitral regurgitation (MR) or mitral incompetence the mitral valve does not close properly and allows abnormal leaking of blood from the left ventricle, through the mitral valve, and into the left atrium, when the left ventricle contracts, i.e. there is regurgitation of blood back into the left atrium. MR is the most common form of valvular heart disease. The mechanical valves are made entirely from metal (Figs 7.12A and B) and pyrolytic carbon and last a lifetime. With this valve, patients are required to take anticoagulant medications to prevent clotting.

Severe tricuspid regurgitation leads to severe pulmonary hypertension and right-sided heart failure with congestive hepatopathy. Clinical and echocardiographic assessment confirms tricuspid valve failure which responds to tricuspid valve replacement surgery.



Figs 7.12A and B

OPINION

Mitral and tricuspid valve replacement.

CLINICAL DISCUSSION

A heart valve allows blood flow in only one direction. The four valves of human heart determine the pathway of blood flow through the heart. A heart valve opens or closes upon differential blood pressure on either side. The two atrioventricular valves, which are between the atria and the ventricles, are the mitral valve and the tricuspid valve.

Mitral valve also known as the “bicuspid valve, because it contains two cusps or flaps, the mitral valve gets its name from a type of hat called as a bishop’s mitre. It allows the blood to flow from the left atrium into the left ventricle. A common complication of rheumatic fever is thickening and stenosis of the mitral valve.

The tricuspid valve has three flaps or cusps as the name suggests and is on the right side of the heart, between the right atrium and the right ventricle which stops the backflow of blood between the two.

Case 78

A 55 years old male came to radiology department for X-ray chest with history of valvular surgery bone twice in the past.



Fig. 7.13

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

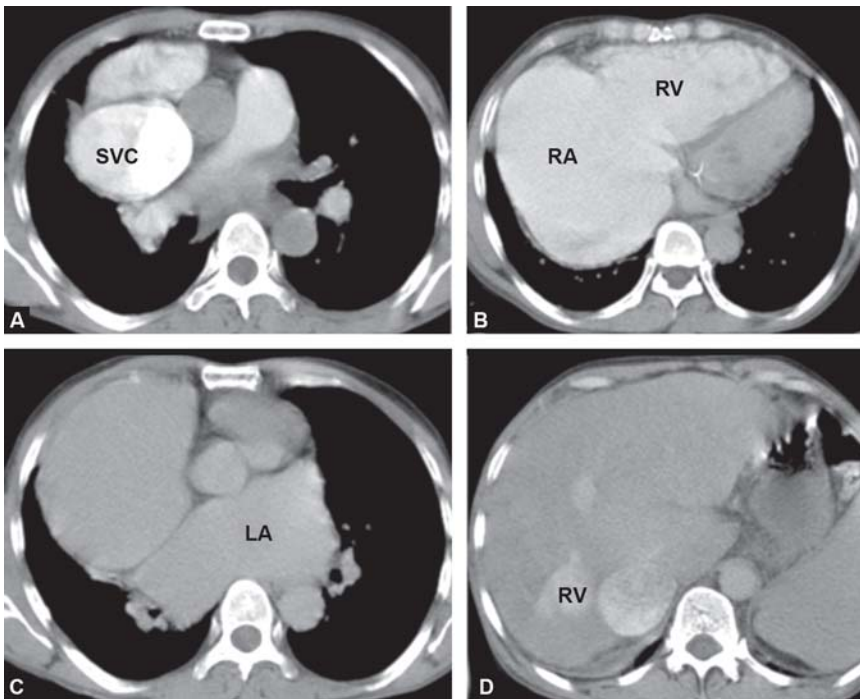
There is history of valvular surgery done twice in the past, details not available. X-ray chest (Fig. 7.13) shows a large heart. The right atrium is grossly enlarged; the left atrium is also enlarged as seen from splaying of carina and lifting of left main bronchus.

COMMENTS AND EXPLANATION

In penetrated X-ray chest the right atrium (Fig. 7.14) shows gross enlargement (white arrow); the left atrium is also enlarged as seen from splaying of carina and lifting of left main bronchus (black arrow).



Fig. 7.14



Figs 7.15A to D

When the left atrium enlarges (Fig. 7.14) it shows a double right heart border, but this border (black arrow) never touches the right dome of diaphragm. When the right atrium enlarges (white arrow), it enlarges to the right and touches the right dome of diaphragm.

The patient was subjected to CT chest (Figs 7.15A to D), which revealed dilated SVC, right atrium, right ventricle, left atrium, IVC and hepatic veins. Right atrium is grossly dilated; features of right heart failure with component of left heart failure are seen. Metallic mitral valve is seen (Fig. 7.15B). There is splaying of carina and esophagus is compressed.

OPINION

Right heart failure.

CLINICAL DISCUSSION

Right-sided heart failure is a condition in which the right side of the heart loses its ability to pump blood efficiently. Right ventricular failure is a backward failure and leads to congestion of systemic capillaries. This generates excess fluid accumulation in the body and causes peripheral edema and usually affects the dependent parts of the body first. Nocturia may occur when fluid from the legs is returned to the bloodstream while lying down at night. In progressively severe cases, ascites and hepatomegaly may develop. Significant liver congestion may result in impaired liver function, and jaundice.

Blood Vessels

Roshan Lodha

Case 79

A 66 years old male hypertensive patient came to radiology department for X-ray chest with history of pain in the neck and right shoulder.



Fig. 8.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 8.1) shows clear lung fields with a cervical rib on right side arising from C7 vertebra and unfolding of aortic arch.

COMMENTS AND EXPLANATION

The term aortic unfolding used in chest X-ray reports, means aging change and this term represents proximal aortic dilation. Unfolding is often associated with aortic calcification, which implies aortic degeneration. The degree of ascending aortic dilation with age is relatively small and out of proportion to the aortic unfolding observed in the chest X-ray. Unfolding is also associated with aortic development of arterial hypertension and isolated systolic hypertension in older subjects.

In another case, bilateral cervical ribs (Fig. 8.2) arising from C7 vertebra, left is larger than right cervical rib (arrows). A cervical rib is a congenital abnormality; it is an extra rib which arises from the cervical vertebra most often from seventh cervical vertebra positioned above the normal first rib. The incidence of cervical rib is about 1 in 200 (0.5%); it may be bilateral or very rarely several cervical vertebrae may develop cervical ribs.



Fig. 8.2

OPINION

Unfolding of aortic arch and cervical rib.

CLINICAL DISCUSSION

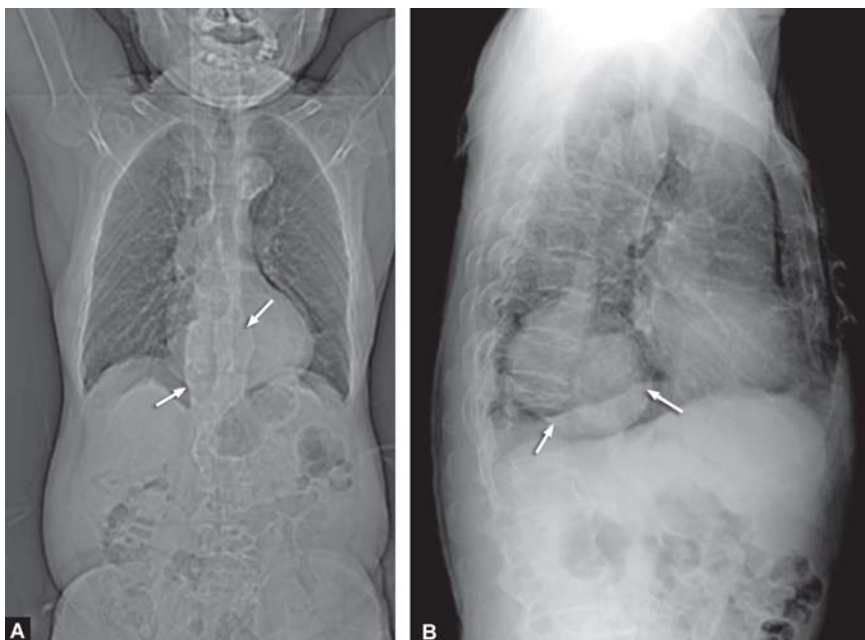
An unfolded aorta is a radiological finding which is commonly seen in older people. On chest radiograph there is widening of the mediastinum which might look like thoracic aortic aneurysm. With advancing age the length of descending aorta increases by approximately 12% per decade, whereas the diameter increases by just 3% per decade. This elongation causes the descending aorta to appear as a vertical shadow on the left

heart border. Aortic unfolding, though not serious, should be differentiated from the more severe dissection of the aorta.

Cervical rib is generally asymptomatic but may rarely present as thoracic outlet syndrome due to compression of the brachial plexus or subclavian artery. Brachial plexus compression may be recognized by wasting of hypothenar muscles and subclavian artery compression is recognized by a positive Adson's sign, where the radial pulse in the arm is lost during abduction and external rotation. Treatment involves physiotherapy, analgesics and in some cases, removal of cervical rib surgically.

Case 80

A 55 years old male patient came to radiology department for X-ray chest with history of dyspnea and chest pain.



Figs 8.3A and B

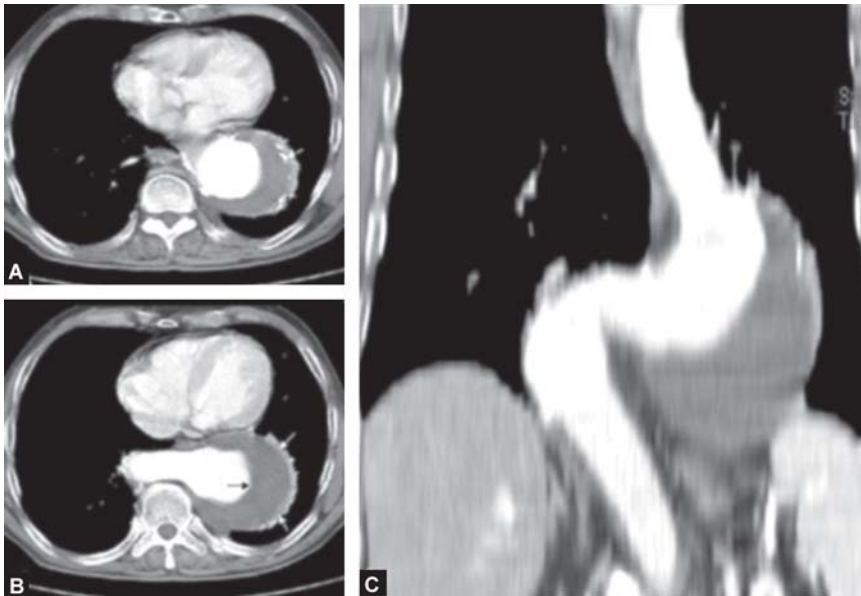
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Figs 8.3A and B) shows clear lung fields with altered contour of distal thoracic aorta and lateral view reveals the aneurysmal dilatation of distal part of thoracic aorta.

COMMENTS AND EXPLANATION

To confirm the finding of X-ray chest, CT scan of the chest was performed. Axial section and coronal reformatted images of CECT chest (Figs 8.4A to C) shows a large descending thoracic aorta aneurysm with a large component of intramural thrombus (arrows) which shows no contrast uptake. Calcification is present in the wall abutting the thrombus (arrow).

CT scan with intravenous contrast is a precise diagnostic tool in the evaluation of thoracic aneurysm. The aneurysm size, extent of disease, presence of leakage and coincident pathology is well demonstrated. Magnetic resonance angiography is highly informative with multiplanar image reconstruction and visualization of extraluminal structures but disadvantage being limited availability, increased cost, and lower resolution than traditional contrast angiography.



Figs 8.4A to C

OPINION

Aneurysm of thoracic aorta.

CLINICAL DISCUSSION

Thoracic aortic aneurysms are less common than aneurysms of the abdominal aorta. Aneurysms are either true or false. A blood vessel has 3 layers: the intima (inner layer made of endothelial cells), media (contains muscular elastic fibers), and adventitia (outer connective tissue). A true aneurysm is defined as a localized dilatation of the aorta with 50 percent over the normal diameter and includes all three layers of the vessel. The wall of a false or pseudoaneurysm only involves the outer layer and is contained by the adventitia.

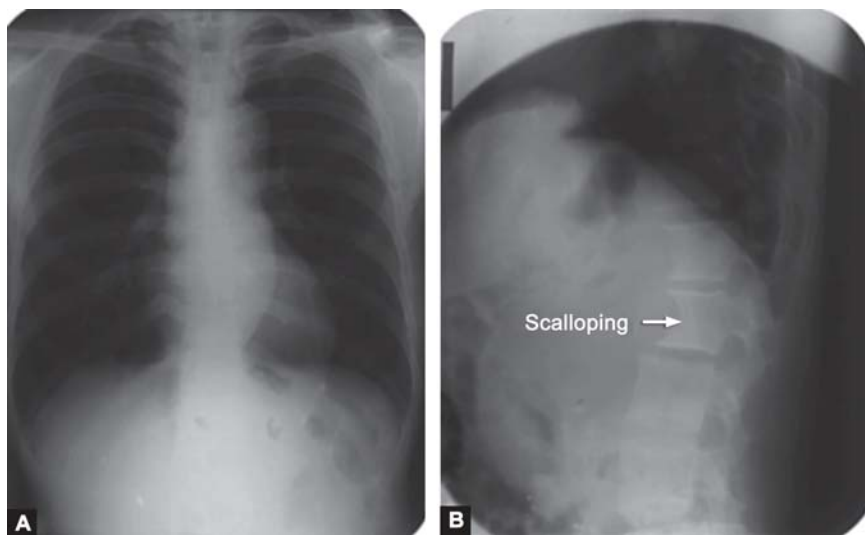
The shape of an aortic aneurysm is either saccular or fusiform. A fusiform or true aneurysm has a uniform shape with a symmetrical dilatation that involves the entire circumference of the aortic wall. A saccular aneurysm is a localized outpouching of the aortic wall seen in pseudoaneurysm.

An aortic dissection is formed by an intimal tear and is contained by the media; hence, it has a true lumen and a false lumen.

Treatment of thoracic aneurysms involves surgical repair. Surgical repair may involve endovascular stent grafting or traditional open surgical repair.

Case 81

A 68 years old hypertensive male came to radiology department for X-ray chest with history of lethargy.



Figs 8.5A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 8.5A) shows clear lung fields with dilatation of distal thoracic aorta which is displaced to the left and returns to its normal position at the level of diaphragm. Lateral view (Fig. 8.5B) of thoracolumbar spine shows scalloping of the anterior margins of bodies of LV1 and LV2.

COMMENTS AND EXPLANATION

In view of the findings found on X-ray chest, thoracoabdominal aortic angiogram (Fig. 8.6) was performed which shows a fusiform aneurysm proximal to the origin of renal arteries and extends just above the abdomen. The dilatation of distal thoracic aorta seen on X-ray film is actually the redundant aorta.

There are two major types of aneurysm morphology: fusiform, and saccular. A pseudoaneurysm or false aneurysm is a collection of blood and connective tissue outside the aortic wall, usually the result of a rupture. The incidence of thoracic aortic aneurysm is estimated to be around six cases per lac patient years. Thoracic aneurysms occur most commonly in the sixth and seventh decade of life.

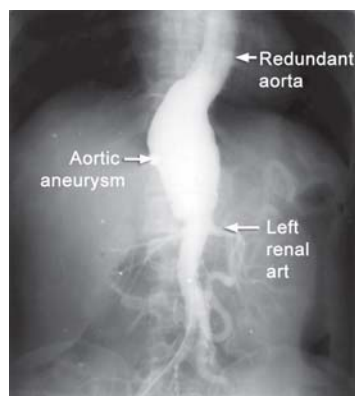


Fig. 8.6

OPINION

Aneurysm of thoracoabdominal aorta.

CLINICAL DISCUSSION

The vast majority of thoracic aneurysms are associated with atherosclerosis. Male:female ratio is 3:1. Hypertension is an important risk factor, being present in 60 percent of patients.

Asymptomatic aneurysms are incidentally detected on routine X-ray chest. The aortic aneurysm produces mediastinal widening or alter contour of the heart or aortic outline.

Case 82

A 48 years old male came to radiology department for X-ray chest with history of cough and fever of 3 days duration.



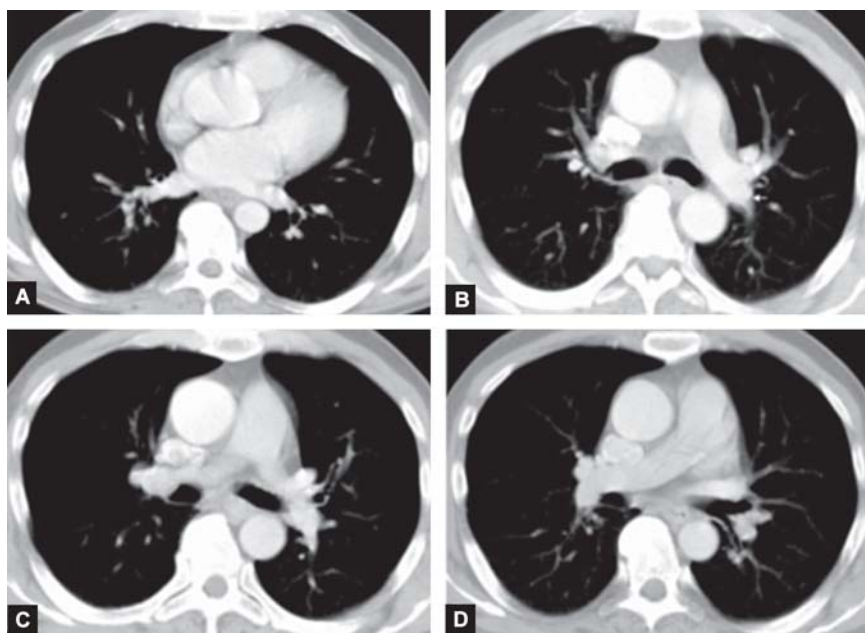
Fig. 8.7

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 8.7) shows that the lung fields are clear. Left hilum is prominent shows an oval lymph node like appearance.

COMMENTS AND EXPLANATION

To confirm the finding on X-ray, CT chest (Figs 8.8A to D) was performed which shows prominent left pulmonary artery but no lymph node. The prominent left pulmonary artery gave a false appearance like a lymph node on chest film.



Figs 8.8A to D

OPINION

Prominent left pulmonary artery mimicking as lymph node.

CLINICAL DISCUSSION

Prominent pulmonary artery mimicking as lymph node is by no means a rare phenomenon. Once a hilar node is seen on chest X-ray one must exclude it to a pulmonary artery by careful review.

Case 83

A 4 months old child was brought to radiology department for X-ray chest with history of failure to thrive.



Fig. 8.9

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 8.9) shows mild cardiomegaly, increased pulmonary vascular markings and “figure of 8” or snowman appearance of mediastinum which is typical for total anomalous pulmonary venous connection (TAPVC) of supracardiac type.

COMMENTS AND EXPLANATION

In TAPVC, Type 1: Supracardiac connection there is cardiomegaly with increased pulmonary arterial markings. There is dilation of the left and right innominate veins and the right superior vena cava (SVC) producing the classical figure of 8 or ‘snowman’ appearance. The superior mediastinum is enlarged secondary to dilation of the superior vena cava, innominate vein and ascending vertical vein. The top or head of snowman is made of superior mediastinal shadow formed by SVC on right side, vertical vein on left side and left brachiocephalic vein superiorly. Bottom or body of snowman is formed by the heart resulting in appearance of a figure of 8 or snowman.

TAPVC classification: Type 1: Supracardiac connection (55%); Type 2: Cardiac connection (30%); Type 3: Infracardiac connection (13%); Type 4: Mixed pattern (2%).

OPINION

Total anomalous pulmonary venous connection.

CLINICAL DISCUSSION

TAPVC consists of an abnormality of blood flow in which all 4 pulmonary veins drain into systemic veins or the right atrium with or without pulmonary venous obstruction. Systemic and pulmonary venous blood mix in the right atrium.

Because all pulmonary venous return connects to the systemic venous system, right atrial and right ventricular enlargement occurs, if significant pulmonary venous obstruction develops, right ventricular hypertrophy occurs. Total anomalous pulmonary venous connection occurs alone in two thirds of patients and occurs as part of a group of heart defects (e.g. heterotaxy syndromes) in approximately one third of patients.

An atrial septal defect or patent foramen ovale is considered part of the complex, serves a vital function for maintaining left ventricular output. Because diagnosis of most patients occurs in early infancy, a ductus arteriosus is frequently found as well.

Case 84

A 37 years old male came to radiology department for X-ray chest with history of abnormal tiredness or fatigue on exertion over a long long period of time.

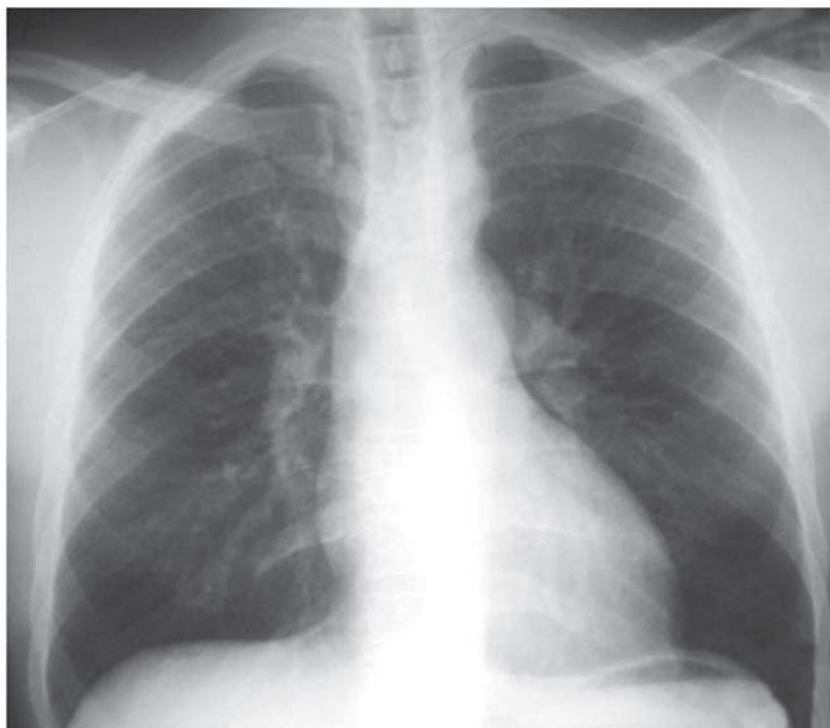


Fig. 8.10

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 8.10) shows bilateral rib notching from 3rd to 6th ribs.

COMMENTS AND EXPLANATION

Enlarged view (Fig. 8.11) shows the rib notching better. Rib notching refers to the notching of inferior surface of the rib. It can affect multiple ribs or single rib and can be unilateral or bilateral. Rib notching occurs due to erosion of the inferior under surface of rib by enlarged vessels, A-V malformations or neurogenic tumors. Bilateral rib notching can occur with enlarged collateral vessels and intercostal arteries in coarctation of the aorta when coarctation typically occurs after the origin of left subclavian artery.

Coronal and sagittal reformatted CT images (Figs 8.12A and B) show the actual site of coarctation (Figs 8.12A and B). Color coded CT angiogram shows exact location of narrowing (Fig. 8.12C) which is after the origin of left subclavian artery.

Unilateral rib notching occurs when: Coarctation of the aorta proximal to the left subclavian artery will cause only right-sided rib notching, coarctation of the aorta with an aberrant right subclavian artery will cause left-sided rib notching, or subclavian artery stenosis: Ipsilateral to the side of stenosis.

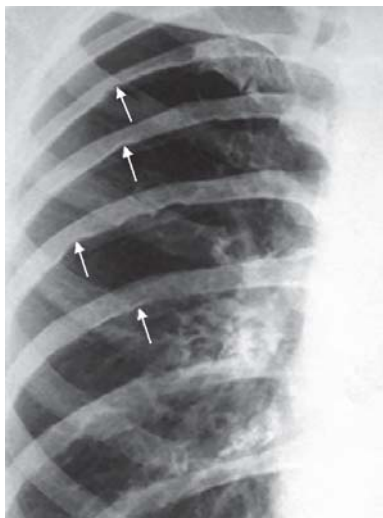
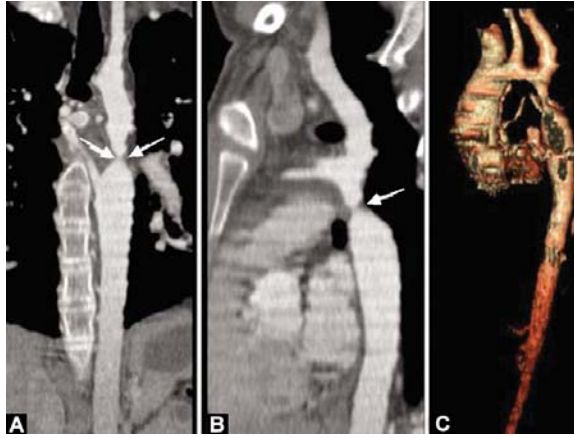


Fig. 8.11

OPINION

Rib notching in coarctation of the aorta.



Figs 8.12A to C

CLINICAL DISCUSSION

Coarctation of the aorta or aortic coarctation, is a congenital condition whereby the aorta narrows in the area where the ductus arteriosus inserts. Coarctation of the aorta may be preductal coarctation, ductal coarctation or postductal coarctation.

Symptoms may be absent with mild coarctation. When present, they include: difficulty in breathing, and failure to thrive. Later on, children may develop an enlarged heart. They may experience dizziness or shortness of breath, faint or near-fainting episodes, chest pain, fatigue, headaches, or nosebleeds. They may have intermittent claudication.

Coarctation of the aorta on X-ray chest shows unilateral or bilateral rib notching, but can be accurately diagnosed with MRI. An untreated coarctation may result in hypertrophy of the left ventricle. Treatment is conservative if asymptomatic, but may require surgical resection of the narrow segment if there is arterial hypertension.

Miscellaneous

Santosh Konde

Case 85

A 33 years old female presented with history of cough for 3 days was subjected to X-ray chest.

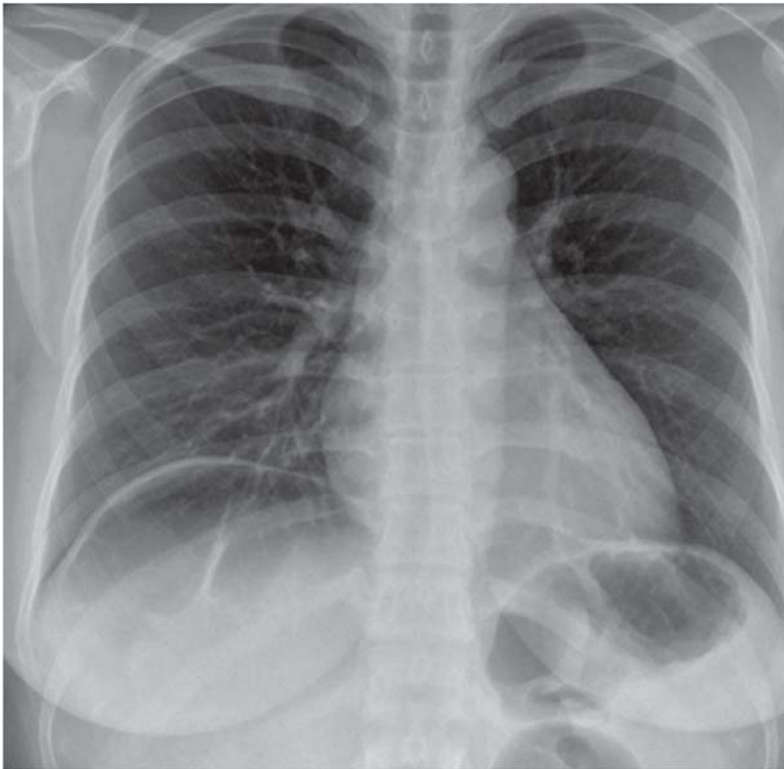


Fig. 9.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

A chest X-ray (Fig. 9.1) revealed hepatodiaphragmatic interposition of the large bowel referred as Chilaiditi sign. She was subjected to CT abdomen.

COMMENTS AND EXPLANATION

CT abdomen (Fig. 9.2) confirmed the presence of grossly dilated large bowel loops anterior to the liver (arrow) and with no evidence of pneumoperitoneum. Persistent or transitory hepatodiaphragmatic interposition of the colon or small intestine referred as Chilaiditi's syndrome or Chilaiditi sign. It is a frequent and generally asymptomatic condition.

However, it may be seen with acute small bowel obstruction from herniation through the falciform ligament, or with volvulus (recurrent or temporary) of the sigmoid and stomach into the right subphrenic space. Interposition of the large or small bowel between the spleen or stomach and the left hemidiaphragm is infrequently seen.

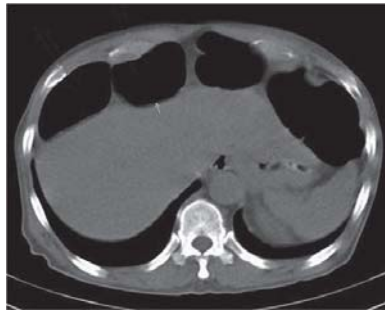


Fig. 9.2

OPINION

Chilaiditi sign.

CLINICAL DISCUSSION

Chilaiditi syndrome is a rare condition when pain occurs due to transposition of a loop of large intestine usually the transverse colon in between the diaphragm and the liver, visible on X-ray abdomen or chest.

Normally this condition has no symptoms, and this is called Chilaiditi's sign. The sign can be permanently present, or intermittently. This anatomical variant is sometimes mistaken for the more serious condition of having air under the diaphragm (pneumoperitoneum) which is usually an indication of bowel perforation. Chilaiditi syndrome refers only to complications in the presence of Chilaiditi's sign. This includes abdominal pain, torsion of the bowel or volvulus.

Case 86

A 10 days old child having respiratory distress was brought to radiology department for X-ray chest.



Fig. 9.3

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 9.3) shows smooth elevation of left hemidiaphragm suggestive of diaphragmatic eventration.

COMMENTS AND EXPLANATION

In eventration the diaphragm is permanently elevated and retains its continuity and attachments to the costal margins and muscular portion of hemidiaphragm are congenitally thin. It generally presents in the neonatal period with respiratory distress (Fig. 9.3). When detected in adults it is seldom symptomatic and often requires no treatment. However, this condition may be confused with a traumatic rupture of the diaphragm in a patient with trauma.

OPINION

Eventration of left hemidiaphragm.

CLINICAL DISCUSSION

Eventration of diaphragm is a congenital anomaly consisting abnormal elevation of part or whole of the hemidiaphragm due to failure of muscular development of part or all of one or both hemidiaphragms. This entity, most often, is incidentally detected on chest radiograph and frequently asymptomatic. Congenital eventration of the diaphragm is due to maldevelopment of the muscular portion of the hemidiaphragm. It can be associated with other congenital anomalies and syndromes. Complete eventration almost invariably occurs on the left side and is rare on the right. Ultrasound is an important imaging modality for the diagnosis of eventration. The other imaging modalities such as fluoroscopy, CT and MR may be performed as adjuvant techniques in cases where the diagnosis still remains in doubt.

Case 87

A 32 years old male presented with nausea and vomiting after meals since one year came to radiology department for X-ray chest.



Fig. 9.4

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

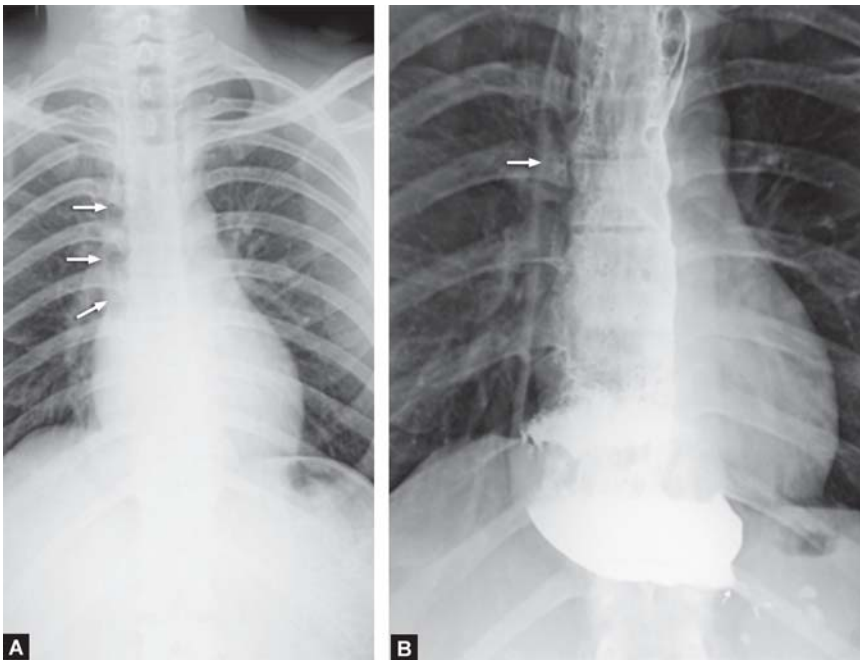
X-ray chest (Fig. 9.4) appears normal at first look, but on careful observation shows an air-filled column behind and adjacent to right heart border with a debatable air-fluid level in retrocardiac region.

COMMENTS AND EXPLANATION

In view of X-ray chest findings barium swallow (Figs 9.5A and B) examination was carried out which shows dilation of the esophagus (white arrow) proximal to the smooth narrowing at lower esophageal sphincter (arrow). In achalasia, the lower esophageal sphincter does not relax properly leading to impaired emptying of esophagus and gradual dilatation of proximal esophagus.

Types: (a) Primary achalasia is the most common subtype and results from loss of ganglion cells in the esophageal myenteric plexus. (b) Secondary achalasia is uncommon and may develop secondary to certain malignancies, diabetes mellitus, and Chagas disease.

X-ray chest may show air-fluid level in retrocardiac region, there may be non-visualization of gastric fundic bubble and aspiration pneumonia. Barium swallow shows dilation of the esophagus proximal to the smooth



Figs 9.5A and B

narrowing at lower esophageal sphincter. The dilation of the esophagus is of variable degree. Distal two thirds of esophagus may be aperistaltic.

Endoscopic ultrasound shows thickened muscle layers in the lower part of esophagus. CT scan demonstrates the structural esophageal abnormalities.

OPINION

Achalasia cardia.

CLINICAL DISCUSSION

Achalasia affects the esophagus. The esophageal sphincter encircles the esophagus just above the entrance to the stomach. This sphincter muscle is normally contracted to close the esophagus. When the sphincter is closed, the contents of the stomach cannot flow back into the esophagus. Reflux can irritate and inflame the esophagus, causing heartburn. The act of swallowing results in peristalsis. Peristalsis pushes food along the esophagus. In achalasia, means failure to relax, the esophageal sphincter remains contracted. Normal peristalsis is interrupted and food cannot enter the stomach. Achalasia is caused by degeneration of the nerve cells that relax the esophageal sphincter. It is an autoimmune disorder.

Patients present with dysphagia for solids and liquids, regurgitation of food, pneumonia due to aspiration of food, severe retrosternal chest pain in 30–40% of patients, weight loss and increased risk for esophageal cancer.

Diagnosis of achalasia begins with a careful medical history. Tests used to diagnose achalasia include: (i) Esophageal manometry (ii) Barium swallow (iii) Endoscopy.

Treatment includes drugs (i) Calcium channel blockers (ii) Anti-cholinergic agents (iii) Nitrates, (iv) Botox injections, endoscopic dilatation and surgical treatment is by Heller's myotomy.

Case 88

A 44 years old male operated for carcinoma esophagus reported for X-ray chest as part of review analysis.



Fig. 9.6

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 9.6) shows a thick white line or band running vertically from the diaphragm in the middle of right lung and joins the mediastinum above the right hilum. Just above the diaphragm an air-fluid is seen to the right of the band.

COMMENTS AND EXPLANATION

The thick line on X-ray chest suggests a structural wall. This is stomach wall in gastric pull-through as treatment for carcinoma esophagus.

OPINION

Gastric pull-through.

CLINICAL DISCUSSION

Mechanisms which lead to failure of esophageal function are carcinoma, chronic fibrosis, disordered motility, chemical, infections, drug-induced injury, chronic reflux disease, traumatic injury, achalasia or scleroderma. These patients may require esophageal reconstruction with gastric pull or colonic interposition.

It is advanced surgical procedure and requires laparoscopic and thoracic surgery skills. Major complications include anastomotic leaks in the neck, descending peri-gastric tube abscess. Minor complications include pleural effusions and atrial fibrillation. Differentials include achalasia, esophageal mass, hiatal hernia.

Knowledge of prior surgical procedure is essential while reporting in radiology or may mislead the interpretation.

Case 89

A newborn baby with difficulty to thrive was brought to radiology department for X-ray chest.

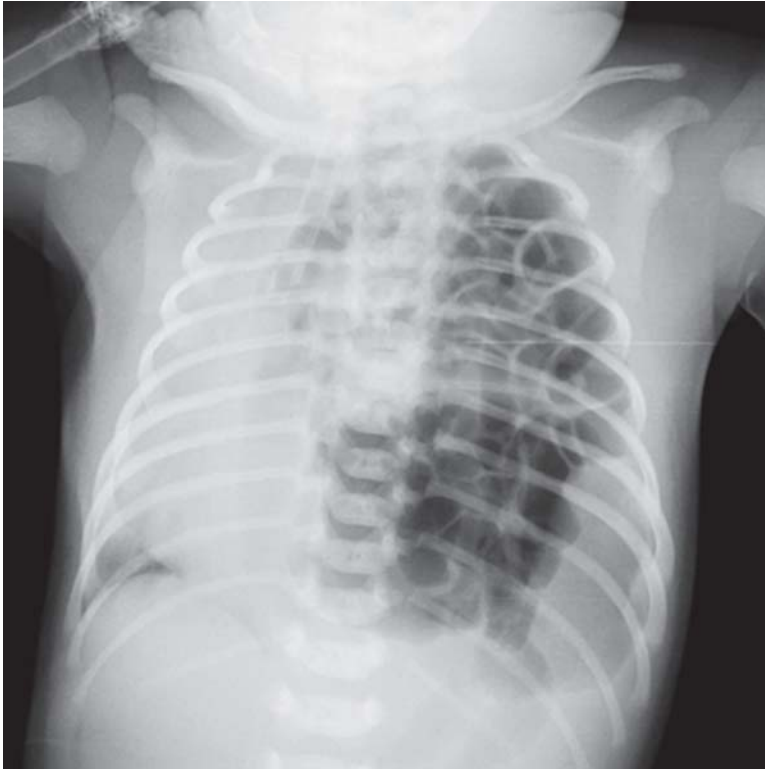


Fig. 9.7

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 9.7) of a newborn shows massive herniation of bowel loops into the left hemithorax. Thus resulting in tracheal and mediastinal shift towards the right. There is collapse of left lung and to a large extent of the right lung, suggesting diaphragmatic hernia (Bochdalek's hernia).

COMMENTS AND EXPLANATION

Bochdalek's hernia is a congenital diaphragmatic hernia in which an opening is present in the infant's diaphragm, which allows normal intra-abdominal organs particularly the stomach and intestines to protrude into the thoracic cavity. In the majority of patients, the resulting lung compression can be life-threatening.

OPINION

Bochdalek's hernia in newborn.

CLINICAL DISCUSSION

Bochdalek's hernias occur more commonly on the posterior left side. Bochdalek's hernia forms either from malformation of the diaphragm, or the intestines become locked into the chest cavity during the development of the diaphragm, there could be genetic and or environmental conditions that can add to the probability of this defect.

The failure of pleuro-peritoneal canal membrane to fuse with the dorsal esophageal mesentery medially and the body wall laterally results in a persistent development defect in the diaphragm posteriorly, it is called the foramen of Bochdalek.

The herniated contents through this foramen of Bochdalek are seen as a posterior mediastinal mass and can present with acute respiratory distress in the neonatal period (Fig. 9.7). The hernia is generally large in size and is detected at early stage of life.

In 80% of cases it is on the left side due to the shielding result of the liver on the right.

Bochdalek's hernia can be a life-threatening condition. Infants with a Bochdalek's hernia have a high mortality rate due to respiratory insufficiency.

The large congenital hernias contain stomach, small intestine and colon, which show as multiple gas-filled ring shadows in the left hemithorax, displacing the heart and mediastinum into the contralateral side and compressing the left lung. The diagnosis is confirmed by CT, barium follow through examination also provides relevant information.

Case 90

A 30 years old male came to radiology department for X-ray chest with history of abdominal discomfort.



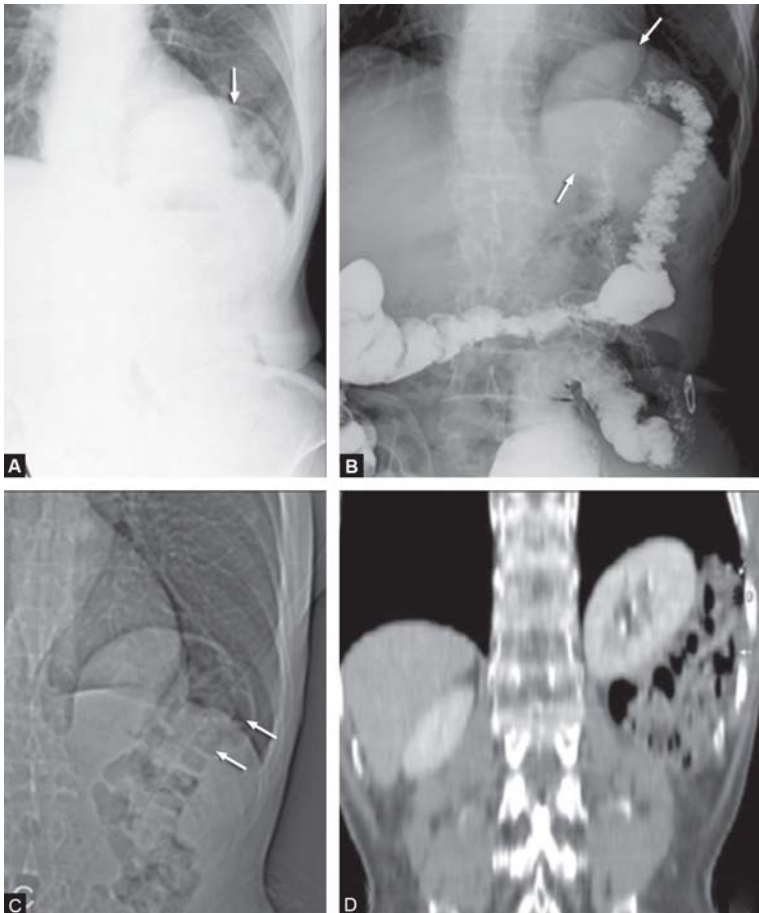
Fig. 9.8

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

On chest X-ray PA view (Fig. 9.8), the lateral end of left diaphragm is well-appreciated and the remaining part is protruding into the chest which has a solid component as well as air suggesting that bowel component has herniated into the chest through a diaphragmatic defect (Fig. 9.9A).

COMMENTS AND EXPLANATION

Barium enema (Fig. 9.9B) was done; it shows the descending colon along with a solid component (arrows) has herniated through Bochdalek foramina. CT Scanogram (Fig. 9.9C) shows clearly the colon (arrows) herniating into the chest through a diaphragmatic defect along with a solid component. Coronal reformatted contrast CT image (Fig. 9.9D)



Figs 9.9A to D

confirms the scanogram findings and the solid component is confirmed as kidney. The failure of pleuro-peritoneal canal membrane to fuse with the dorsal esophageal mesentery medially and the body wall laterally results in a persistent development defect in the diaphragm posteriorly, it is called the foramen of Bochdalek.

OPINION

Bochdalek's hernia in adult.

CLINICAL DISCUSSION

Bochdalek hernia is posterolateral diaphragmatic hernia that primarily manifests in children. It is rare in adults and accounts for about 0.17% to 6% of all diaphragmatic hernias. The clinical presentation of adult Bochdalek hernia is varied and is mainly confined to the respiratory or gastrointestinal systems. Imaging plays an important role in diagnosing and assessing the contents of the hernia and at the same time evaluating the presence of any associated abnormality. The organs that most commonly herniate into the thorax through this defect are stomach, ileum, colon and spleen. The liver and the right kidney may herniate along with the bowel loops if the defect is on the right side. The diagnosis is more difficult if the hernia only contains the spleen or kidney or when the bowel is fluid filled. The diagnosis is confirmed by CT, barium meal follow through examination also provides relevant information.

Diaphragm

Abhijit Pawar

Case 91

A 32 years old male having fever of one week duration came to radiology department for X-ray chest.



Fig. 10.1

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 10.1) shows normal lungs with normal cardiac configuration. It shows a grossly enlarged spleen in its normal position.

COMMENTS AND EXPLANATION

In splenomegaly, spleen size measures more than 12 cm by ultrasound along its long axis and it is considered massive splenomegaly if the largest dimension of spleen is greater than 20 cm, clinically palpable spleen means that it has enlarged by at least two folds and symptoms may include abdominal pain and chest pain. On abdominal radiograph outline of spleen is visualized. CT and MRI aids in identifying associated anomalies.

OPINION

Massive splenomegaly.

CLINICAL DISCUSSION

Splenomegaly is usually associated with increased workload, which suggests that it is a response to hyperfunction. Splenomegaly (Fig. 10.2) includes any disease process that involves abnormal red blood cells destruction in the spleen. Other causes are congestion due to portal hypertension and infiltration by leukemias and lymphomas. A few causes of massive splenomegaly are thalassemia, visceral leishmaniasis (kala-azar), malaria, schistosomiasis, chronic leukemias, polycythemia vera, Gaucher's disease, Niemann-Pick disease, sarcoidosis, autoimmune hemolytic anemia. Patient present with abdominal pain, back pain, palpable mass or symptoms associated with underlying cause. On examination, spleen is palpable in left upper quadrant as a mass splenic rub. In hypersplenism, a splenectomy is indicated. After splenectomy, patients have increased risk for infectious diseases.

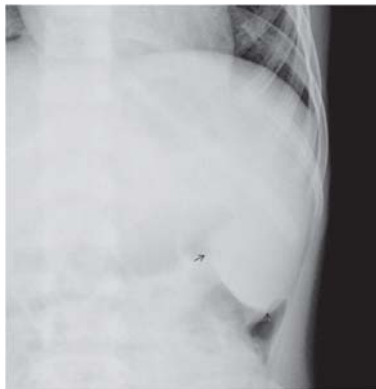


Fig. 10.2

Case 92

A 28 years old male who presented with hard to firm swelling in right suprascapular region and another on the medial aspect of left upper arm came to radiology department for X-ray chest.



Fig. 10.3

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 10.3) shows clear lung fields with normal cardiac configuration, a large bony outgrowth-exostosis arising from superior medial aspect of right scapula. Another exostosis is seen to arise from medial margin of upper shaft of left humerus and another small bony outgrowth from the lateral margin of upper 3rd shaft of right humerus.

COMMENTS AND EXPLANATION

It is difficult to pin-point the exact origin of exostosis nor is it possible to say if this large exostosis is pedunculated or sessile which is important from surgery point of view. So to have more information CT chest was performed.

On CT chest the origin of exostosis can be best evaluated. On coronal reconstruction (Fig. 10.4), a large exostosis is seen to arise from the antero-superior margin of right scapula. This exostosis has a pedicle which was not appreciated on PA chest, is clearly seen on CT.

Plain X-ray may be the only imaging study required. CT scan is useful in the assessment of osteochondromas in the pelvis, shoulder or spine. MRI scan is useful in the assessment of malignant transformation and for evaluating compression of the spinal cord, nerve roots and peripheral nerves.



Fig. 10.4

OPINION

Diaphyseal aclasis.

CLINICAL DISCUSSION

Diaphyseal aclasis is also known as external chondromatosis syndrome, multiple exostoses, or multiple osteochondromatosis. Usually presents during the first decade of life. It is characterized by multiple exostosis or bony protrusions and is inherited autosomal dominant disorder. Long bones are usually affected more severely and more frequently than the short bones but they also often involve the medial borders of the scapulae, ribs and iliac crests. The malignant change is more frequent compared to the solitary exostosis. Most of the osteochondromas are painless and the main concern is often cosmetic.

Case 93

A 30 years old male patient who presented with sudden attack of pain in epigastrium to the right of midline with board like rigidity, tenderness, and rebound tenderness of abdomen came to radiology department for erect X-ray chest.

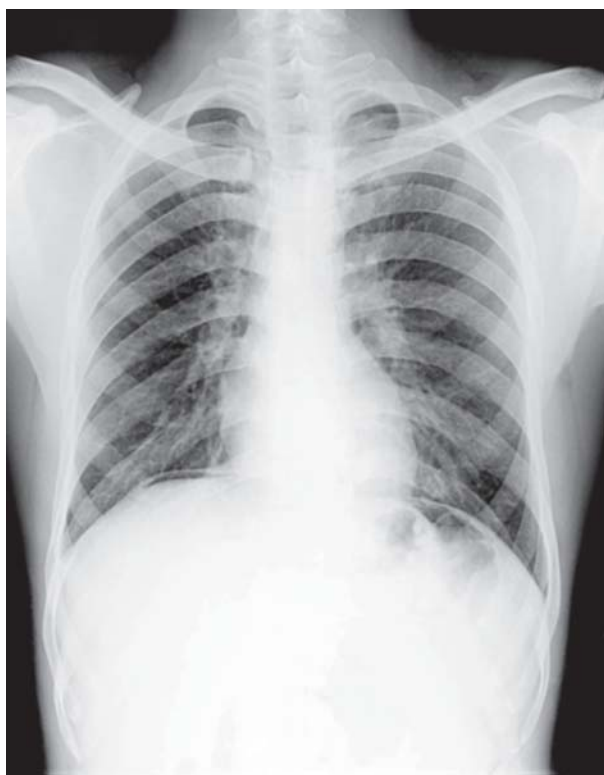


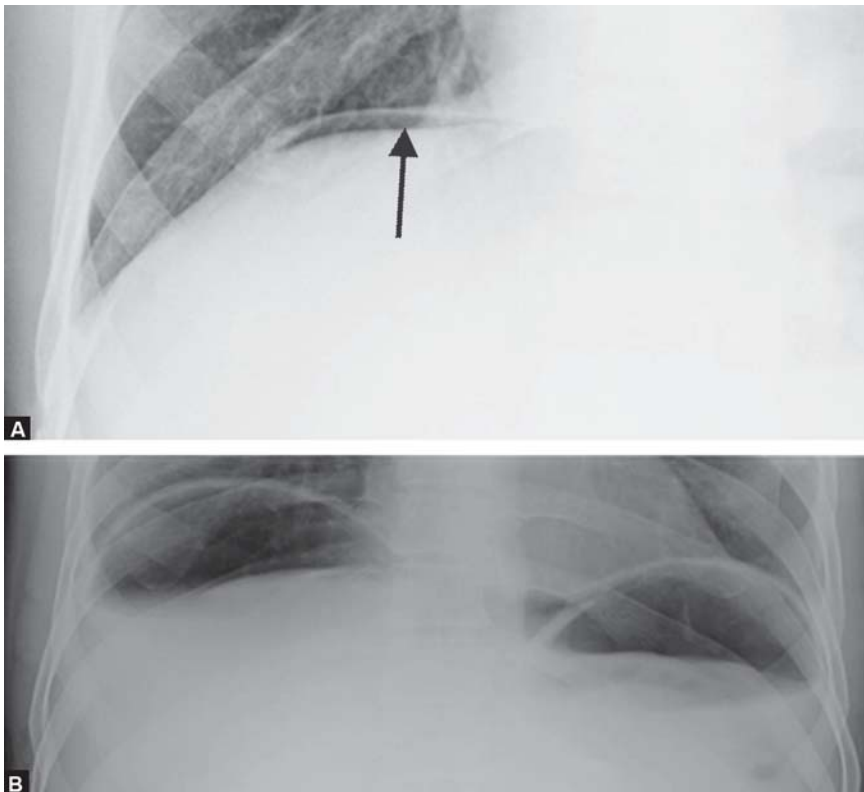
Fig. 10.5

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest erect film (Fig. 10.5) shows clear lung fields with normal cardiac configuration, small quantity of free air is seen under the right dome of diaphragm (pneumoperitoneum).

COMMENTS AND EXPLANATION

Pneumoperitoneum is presence of free gas within the peritoneal cavity. It is most often caused by perforated abdominal viscus and can present as acute medical emergency as in this case. When the gas is small in quantity it is best picked up on erect chest X-ray (Fig. 10.6A) as free gas under the dome of diaphragm (arrow). Another manifestation of massive pneumoperitoneum is the continuous diaphragm sign. Where there is sufficient air beneath the diaphragm, the continuous nature of the diaphragm is demonstrated or may produce a continuous diaphragm sign or it may be double air bubble (Fig. 10.6B), one under each diaphragm. Nowadays CT is regarded as criterion standard for pneumoperitoneum.



Figs 10.6A and B

OPINION

Pneumoperitoneum.

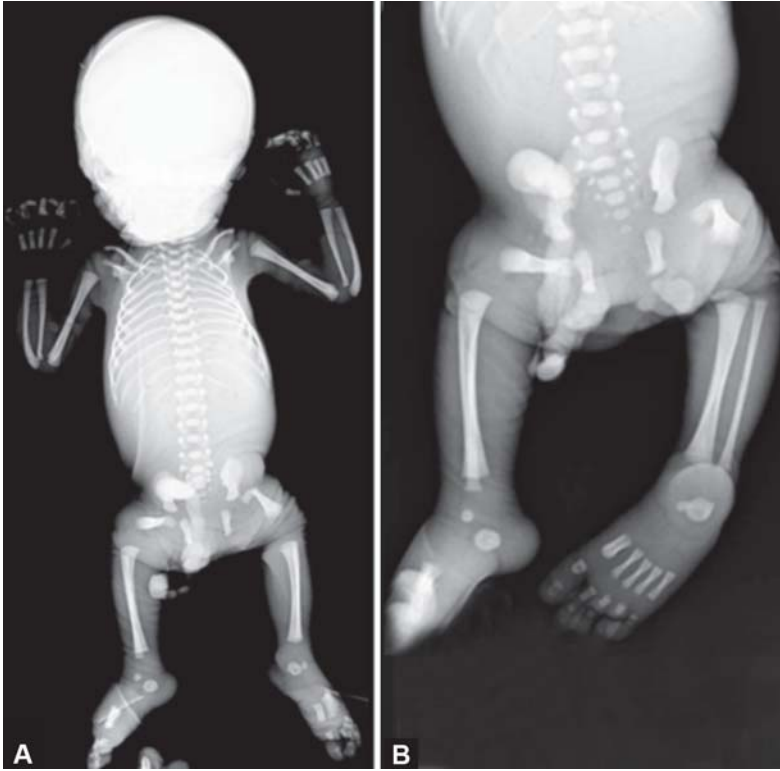
CLINICAL DISCUSSION

According to James Begg, "The radiological signs of pneumoperitoneum are among the most important signs in radiology, indeed in Medicine. Sometimes the amount of free gas is small and you may have to work to demonstrate it (i.e. modify the film technique). Miss it and the patient may die". This means that the supine signs of pneumoperitoneum may be subtle, and then the radiographer must be able to identify the signs on the supine image and know that erect film or other supplementary views will prove the existence of free intraperitoneal gas. The most common cause is a perforated abdominal viscus, generally a perforated peptic ulcer, although any part of the bowel may perforate from a benign ulcer, tumor or abdominal trauma. A perforated appendix seldom causes a pneumoperitoneum. A pneumoperitoneum is deliberately created by the surgical team in order to perform laparoscopic surgery by insufflating the abdomen with carbon dioxide.

The most common cause of a spontaneous pneumoperitoneum is the introduction of air through the female genital tract.

Case 94

A stillborn baby was brought to radiology department for X-ray kiddiegram.



Figs 10.7A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Kiddigram (Figs 10.7A and B) of a stillborn shows failure of aeration of lungs with right proximal femoral focal deficiency (PFFD).

COMMENTS AND EXPLANATION

Stillborn which shows failure of aeration of lungs should be examined for proximal femoral focal deficiency, a unique group of congenital femoral hypoplasias wherein there is a localized absence of proximal end of the femur involving the ileo-femoral joint, it is recognized as a distinct type of skeletal limb deficiency. It should be considered separate from other femoral deformities such as complete shaft absence, development of coxa and the generalized dysplasias.

Radiological evaluation includes evaluation of the associated limb anomalies, of which ipsilateral fibular hemimelia is the most common. Contrast arthrography may be indicated to show the presence and location of the femoral head. Figures 10.7A and B show kiddiegram of a stillborn with failure of aeration of lungs and right proximal femoral focal deficiency.

OPINION

Proximal femoral focal deficiency.

CLINICAL DISCUSSION

PFFD is a rare, non-hereditary birth defect that affects the pelvis, particularly the hip bone, and the proximal femur. The disorder may affect one side or both, with the hip being deformed and the leg shortened. The condition is usually apparent at birth. Patient present with limb length inequality, malrotation, instability at hip joint and weakness of the proximal musculature. Associated anomalies include absence or shortening of a leg bone (fibular hemimelia) and the absence of a kneecap, a shortened tibia or fibula, and foot deformities.

Management strategies are aimed at improving functional ambulation and are largely dependent on the degree of femoral shortening and the status of the hip and knee joint.

Anomaly scan can detect the condition.

Case 95

A 7 years old girl was brought to radiology department for X-ray chest with history of stunted growth and inability to walk.



Fig. 10.8

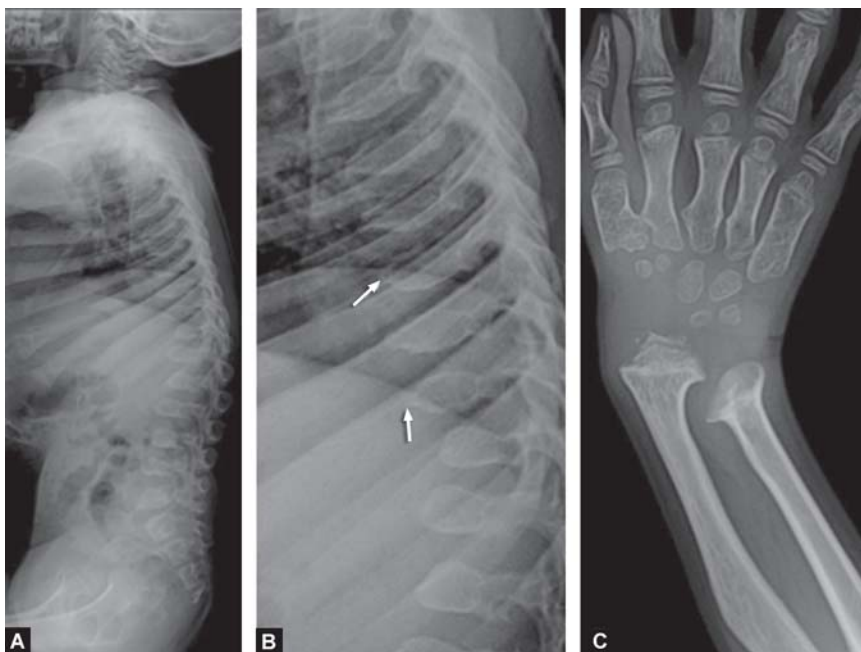
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 10.8) shows no parenchymatous lesion. The scapulae show demineralization. The epiphysis of head of humerus is irregular and fragmented on the left side with irregular metaphyses. The ribs are more flat. These findings suggest for a skeletal survey.

COMMENTS AND EXPLANATION

Once the lung fields show no pathology one should look for pathology in soft tissue and the bones which are visible on the film. Skeletal survey was done which confirmed the lesions as part of mucopolysaccharidoses (MPS).

The vertebral bodies are reduced in height; they appear more flat and on lateral view show a central tongue like projection from the anterior margin of vertebral bodies (Figs 10.9A and B). This appearance is best seen in lower thoracic and upper lumbar vertebrae, this may result in kyphosis. The metacarpals are pointed proximally. The distal radius and ulna are angulated. The radius and ulna are wide with irregular metaphyses (Fig. 10.9C). The epiphyses are irregular and fragment.



Figs 10.9A to C

OPINION

Mucopolysaccharidoses.

CLINICAL DISCUSSION

Mucopolysaccharidoses are a group of metabolic disorders (lysosomal storage disorders) caused by the absence or malfunctioning of lysosomal enzymes needed to break down molecules called glycosaminoglycans. The mucopolysaccharidoses share many clinical features but have varying degrees of severity. These features may not be apparent at birth but progress as storage of glycosaminoglycans affects bone, skeletal structure, connective tissues, and organs. They are classified as:

- MPS I Hurler syndrome
- MPS II Hunter syndrome
- MPS III Sanfilippo syndrome
- MPS IV Morquio syndrome
- MPS VI Maroteaux-Lamy syndrome
- MPS VII Sly syndrome

Diagnosis is made through clinical examination and urine examination. Enzyme assays are used to provide definitive diagnosis. Medical care is directed at treating systemic conditions and improving the person's quality of life. Physical therapy and daily exercise delay joint problems and improve the ability to move.

Case 96

A 67 years old male came to radiology department for X-ray chest with history of cough for few days.



Fig. 10.10

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest (Fig. 10.10) shows well defined increased density in midline in cervico-thoracic region. A lateral view of chest was advised

COMMENTS AND EXPLANATION

X-ray lateral view chest (Fig. 10.11) shows a midline smooth soft tissue lesion in the cervico-dorsal spine and is meningocele or meningoencephalocele depending on its contents. If only cerebrospinal fluid (CSF) and meninges herniate through a congenital defect in the vertebral column, it is termed as a meningocele, if neural elements along with meninges herniate in a sac through the congenital defect; it is termed as a meningo-myelocele. The two can be distinguished on CT or MRI with much more information on the lesion.



Fig. 10.11

OPINION

Meningocele or meningoencephalocele.

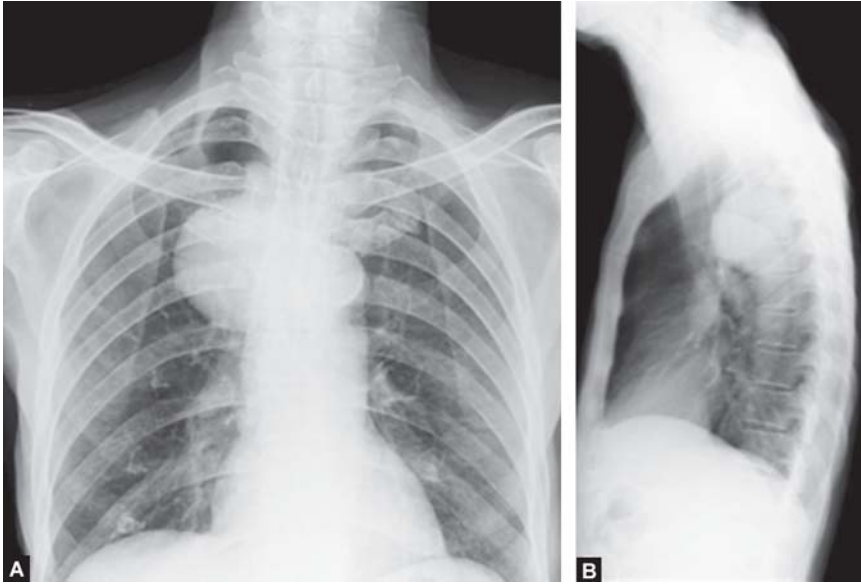
CLINICAL DISCUSSION

Meningocele, meningo-myelocele is congenital condition characterized by protrusion of sac like cyst through the defect in spinal column (spina bifida). Patient present with swelling over the back, with or without sensory or motor deficit and intellectual abnormalities. Meningo-myelocele most commonly occur in the lumbosacral region but they can occur at any level in the neuraxis. Associated congenital defects include clubfoot, hydrocephalus, and extrophy of bladder, prolapsed uterus, Klippel-Feil syndrome and congenital cardiac defects. Differentiation between neural tube defects is important and this is best done on MRI. Depending on the contents of sac surgery can be planned.

Triple test and anomaly ultrasound scan are useful screening tools for neural tube defects in second trimester.

Case 97

A 28 years old male patient came to radiology department with history of cough for two weeks came to radiology department for X-ray chest.



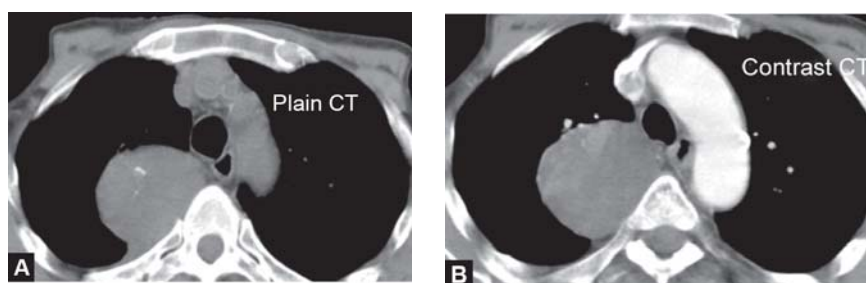
Figs 10.12A and B

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest PA and lateral views (Figs 10.12A and B) show a well-defined right paratracheal mass without calcification lying in the posterior mediastinum. CT chest was advised.

COMMENTS AND EXPLANATION

CT chest (Figs 10.13A and B) axial scans show a spherical well-defined soft tissue mass in right posterior mediastinum with punctate calcific densities within, in close proximity to T3 and T4 vertebrae measuring $6 \times 5 \times 5$ cm. The lesion is seen adjacent to trachea, right main bronchus and esophagus. It shows minimal enhancement on postcontrast studies and was diagnosed as neurogenic tumor. Neurofibromas have low attenuation on CT scans and enhance heterogeneously on postcontrast scans. Schwannomas have attenuation similar to that of muscles on CT scans and enhance mildly with contrast.



Figs 10.13A and B

OPINION

Neurogenic tumor.

CLINICAL DISCUSSION

Neurogenic tumors are generally grouped into three categories: those arising from peripheral nerves, sympathetic ganglia, and parasympathetic ganglia. Schwannoma, neurofibroma and malignant tumor of nerve sheath origin arise from the peripheral nerves. Approximately, 10% of nerve sheath tumors grow through the intervertebral foramen into the spinal canal producing a “dumbbell” configuration.

Neurogenic tumors represent approximately 20% of all adult and 35% of all pediatric mediastinal neoplasms. Neurogenic tumors are the most common cause of a posterior mediastinal mass. Approximately, 90% occur in the posterior mediastinum. Seventy to 80% are benign and approximately half of the patients are asymptomatic.

Case 98

A 22 years old female having fever of three days duration came to radiology department for X-ray chest.

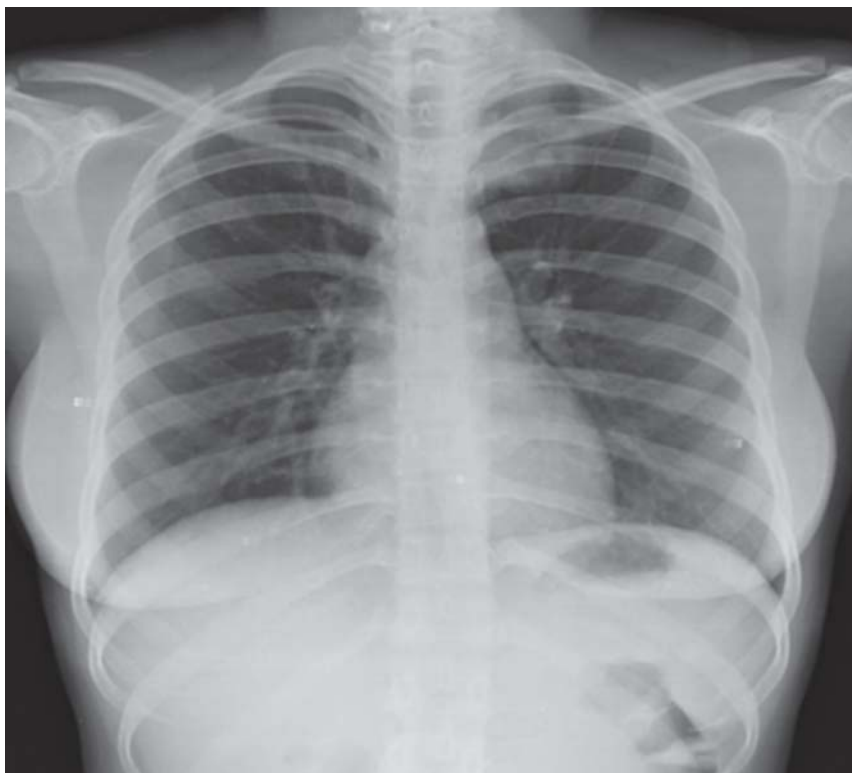


Fig. 10.14

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 10.14) shows a soft tissue density shadow in left apex.

COMMENTS AND EXPLANATION

At a closer look (Fig. 10.15) at the soft tissue density shadow in left apex it is seen to extend upwards beyond the lungs on to the neck suggesting the lesion to be apparent due to the bun made out by plait of hairs (arrows).

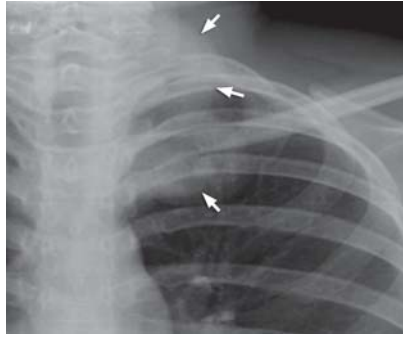


Fig. 10.15

OPINION

Plait of hairs.

CLINICAL DISCUSSION

A hair plait or strands of hair may create an apparent superimposed lesion often in region of apex of the lung. Hence it is important to train the technician to ensure that the hairs of the female patients are properly tied prior to exposure of chest X-ray. Synthetic hair braids are a popular hairstyle in the African-American community, and are known to produce artifacts.

Case 99

A 12 years old female presented with history of cough for 10 days was subjected to X-ray chest.

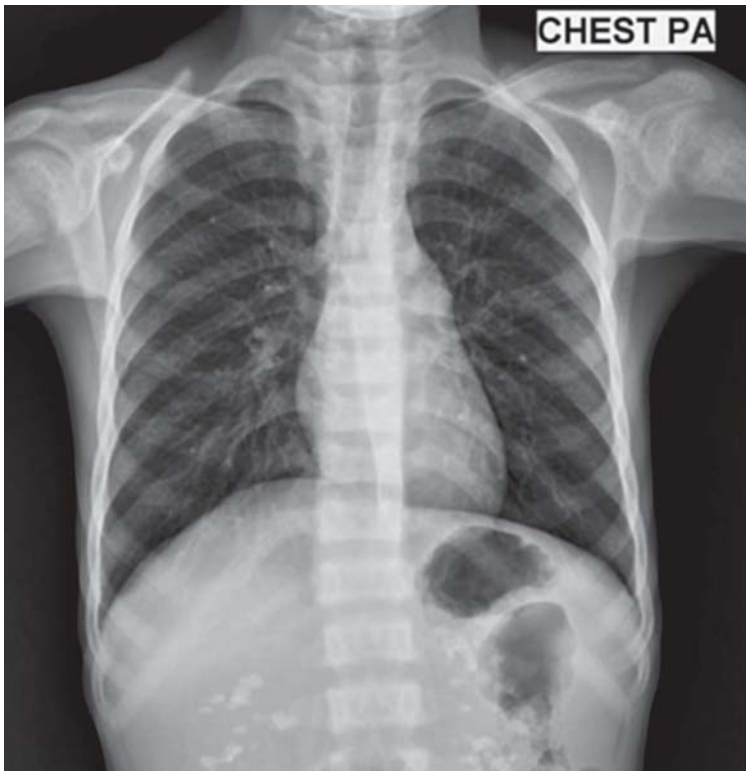


Fig. 10.16

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Chest X-ray (Fig. 10.16) shows no parenchymatous lung lesion, cardiac size and configuration is normal. However, when the eyes move below the diaphragm there is presence of diffuse, fine, calcification in both renal areas thus making a diagnosis of nephrocalcinosis.

COMMENTS AND EXPLANATION

Nephrocalcinosis, also known as Albright's calcinosis, is commonly used for diffuse, fine, renal parenchymal calcification. It is most commonly seen as an incidental finding with medullary sponge kidney on an abdominal X-ray.

OPINION

Nephrocalcinosis.

CLINICAL DISCUSSION

Nephrocalcinosis may be severe enough to cause renal tubular acidosis or even end stage renal failure, due to disruption of the renal tissue. This condition is usually asymptomatic. Causes of nephrocalcinosis include hyperparathyroidism, renal tubular acidosis, renal tuberculosis, renal papillary necrosis tumor lysis syndrome, acute phosphate nephropathy, and occasional cases of enteric hyperoxaluria.

Case 100

A 37 years old male came to radiology department who presented with signs of dyspnea, productive cough with recurrent respiratory infection and cold.



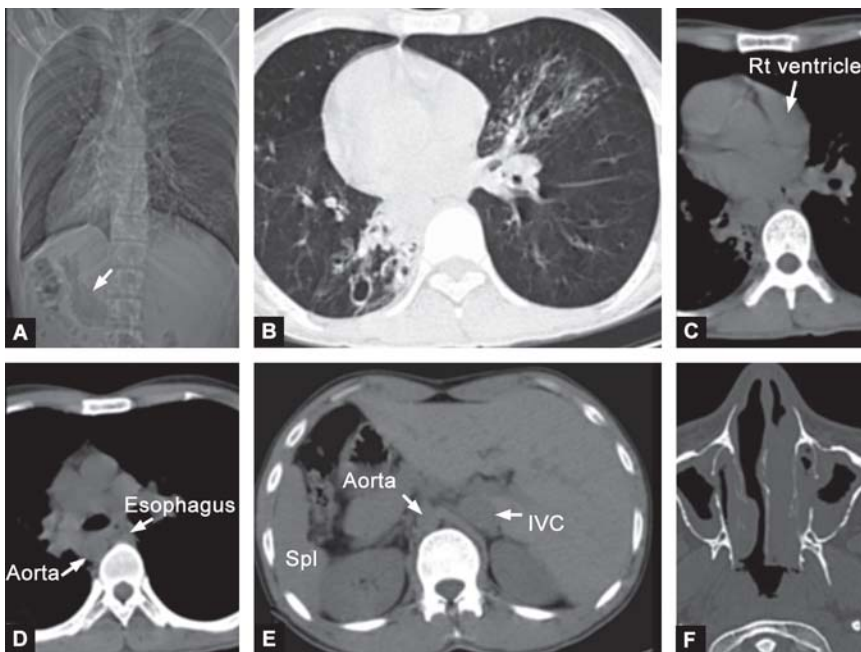
Fig. 10.17

RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

X-ray chest scanogram (Fig. 10.17) shows situs inversus with heart and stomach (arrow) on the right side, with bilateral bronchiectasis seen in left base and right hilar and subhilar regions seen through the heart shadow.

COMMENTS AND EXPLANATION

Kartagener syndrome is situs inversus (reversal of the internal organs) accompanied by bronchiectasis and chronic sinusitis. Figure 10.18A shows situs inversus with heart and stomach (arrow) on the right side (Figs 10.18B to D). Axial CT chest shows bronchiectasis, dextrocardia with morphologic right ventricle on the left and the left ventricle on the right (Fig. 10.18E). Plain axial CT at the level of renals shows liver and IVC on the left and the spleen and aorta on the right (Fig. 10.18F). Axial



Figs 10.18A to F

CT PNS shows chronic sinusitis in an individual with Kartagener syndrome.

OPINION

Kartagener syndrome.

CLINICAL DISCUSSION

Kartagener's syndrome in most cases is observed before the age of 15 years. It is autosomal recessive inheritance. Symptoms and signs are dyspnea, productive cough, recurrent respiratory infection and cold, bouts of pneumonia, rheumatoid arthritis, anosmia and clubbing of fingers.

Kartagener's syndrome is a type of congenital dyskinetic ciliary syndromes the 'immotile cilia syndrome'. It is now postulated that the beating of embryonic cilia determines organ situs if the beat is abnormal the situs will be randomly allocated and 50% will have situs inversus. Sperm tails are also cilia, and males with the condition will be infertile, hence explaining the combination of bronchiectasis, situs inversus, chronic sinusitis and male infertility in Kartagener's syndrome.

Case 101

A male neonate was brought to radiology department for kiddiegram who presented with limb deformities since birth.



Fig. 10.19

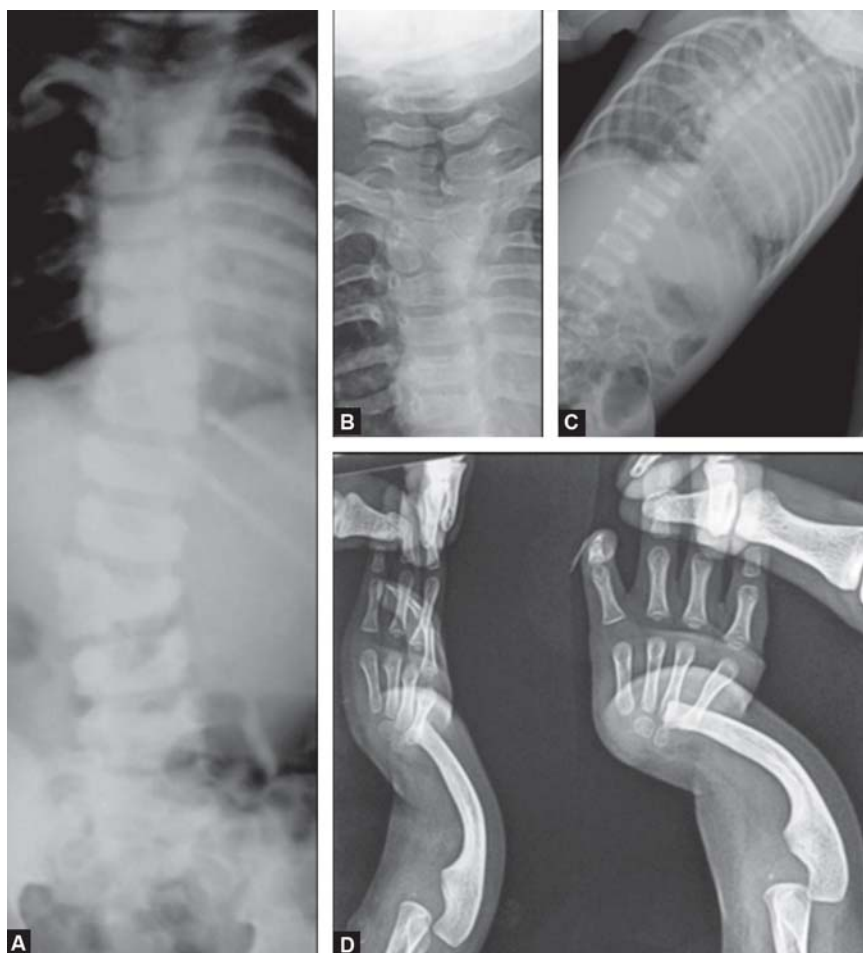
RADIOLOGICAL FINDINGS ON X-RAY EXAMINATION

Kiddiegram (Fig. 10.19) shows cardiomegaly with enlargement with increased pulmonary vascularity suggesting congenital heart disease (VSD) with absence of right radius. X-rays spine, forearms and hand are advised.

COMMENTS AND EXPLANATION

X-rays spine, forearms and hand show multiple spinal anomalies, absence of radius and deformities of hands (Figs 10.20A to D). All these are features of Holt Oram syndrome.

Holt-Oram syndrome is an inherited disorder that causes abnormalities of the heart, hands, arms, and spine. Heart abnormalities are seen in three-fourth of cases with Holt-Oram syndrome. It may be atrial or



Figs 10.20A to D

ventricular septal defect or abnormal rhythm. Other components are defects in arm and hand bones involving one or both sides of the body. Most commonly the defects are in the carpal bones and thumb. The thumb may be malformed or missing. In severe cases the arms may be very short such that the hands are attached close to the body (phocomelia).

OPINION

Holt-Oram syndrome.

CLINICAL DISCUSSION

Holt-Oram syndrome, also known as heart-hand syndrome or atriocardial dysplasia. It is an autosomal dominant disorder characterized by abnormalities of the upper limbs and heart. Patients have a family history of cardiac and or limb malformation. It occurs approximately one in 100,000 live births and affects both sexes equally. Patients may present in infancy with obvious limb malformations and/or signs of cardiac failure. It may affect one or both upper limbs. If both upper limbs are affected, the bone abnormalities can be the same or different on each side. It is important that once an individual has been diagnosed with Holt-Oram syndrome, his family members should be screened for the syndrome. Genetic counseling is essential.

Spotters

Amol Sasane



Fig. 11.1: Bilateral upper lobes fibrosis with emphysematous chest, star-shaped pleural calcification seen in RLZ



Fig. 11.2: Right hilar mass

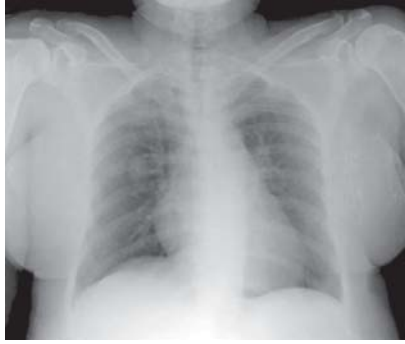


Fig. 11.3: Solitary pulmonary nodule right lung



Fig. 11.4: Pulmonary edema



Fig. 11.5: Destroyed left lung



Fig. 11.6: Kyphoscoliosis

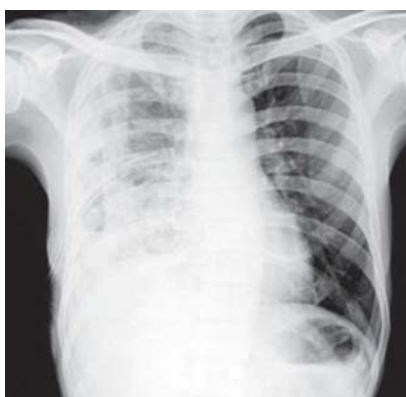


Fig. 11.7: Pyopneumothorax with intercostals drainage tube in situ

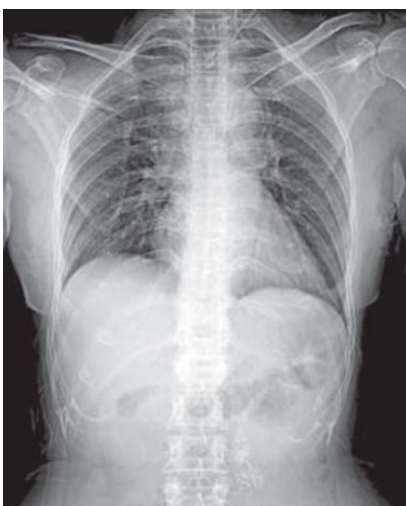


Fig. 11.8: Calcified guinea worm seen left apex and base of neck, and abdominal wall



Fig. 11.9: Jeune's syndrome

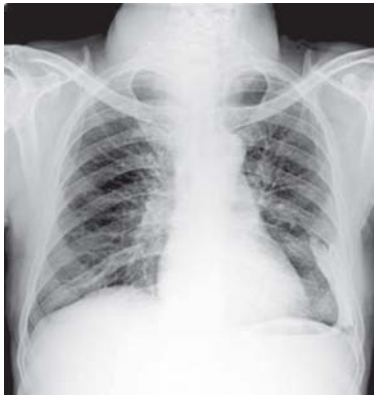


Fig. 11.10: Pleural calcification with goiter



Fig. 11.11: Pathological fracture left humerus and metastasis lateral end of left clavicle



Fig. 11.12: X-ray chest of one year old child with abscess right lung with air fluid. Left lung shows lower zone consolidation



Fig. 11.13: X-ray chest of 12 years old male shows pleural effusion with collapse consolidation of right lung

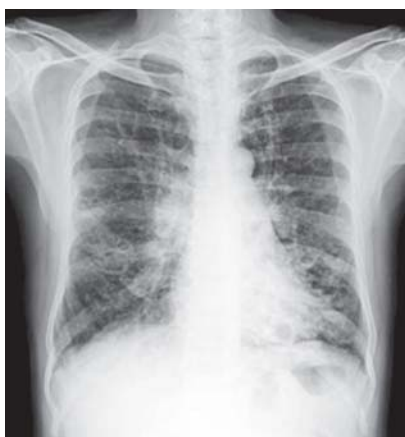


Fig. 11.14: Bilateral bronchiectasis

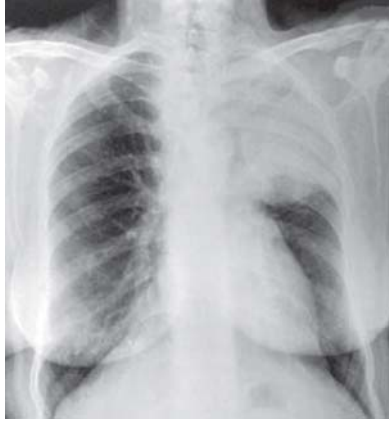


Fig. 11.15: Hydatid cyst lung



Fig. 11.16: Pneumothorax left

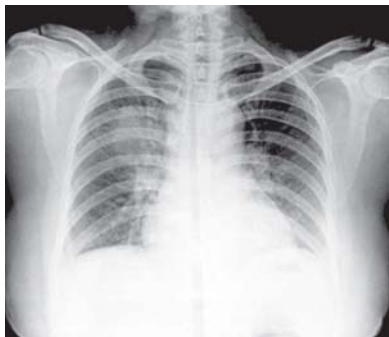


Fig. 11.17: Pneumonic consolidation



Fig. 11.18: Mediastinal widening seen in lymphoma



Fig. 11.19: Pulmonary edema with endotracheal tube, Ryle's tube and central venous catheter (CVC) superior vena cava

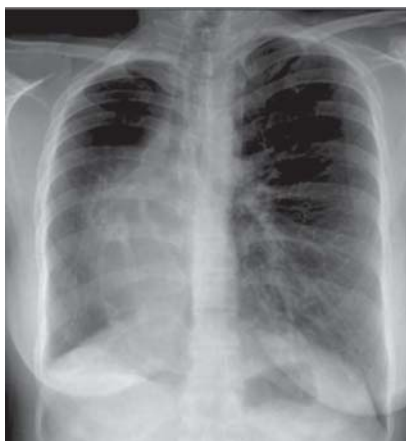


Fig. 11.20: Right lung hypoplasia

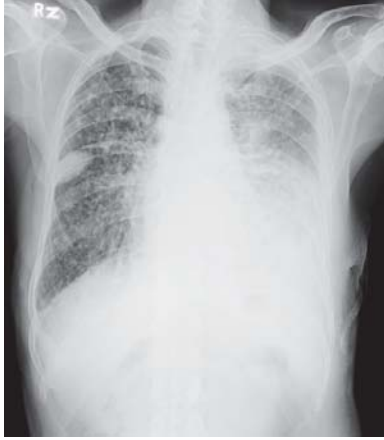
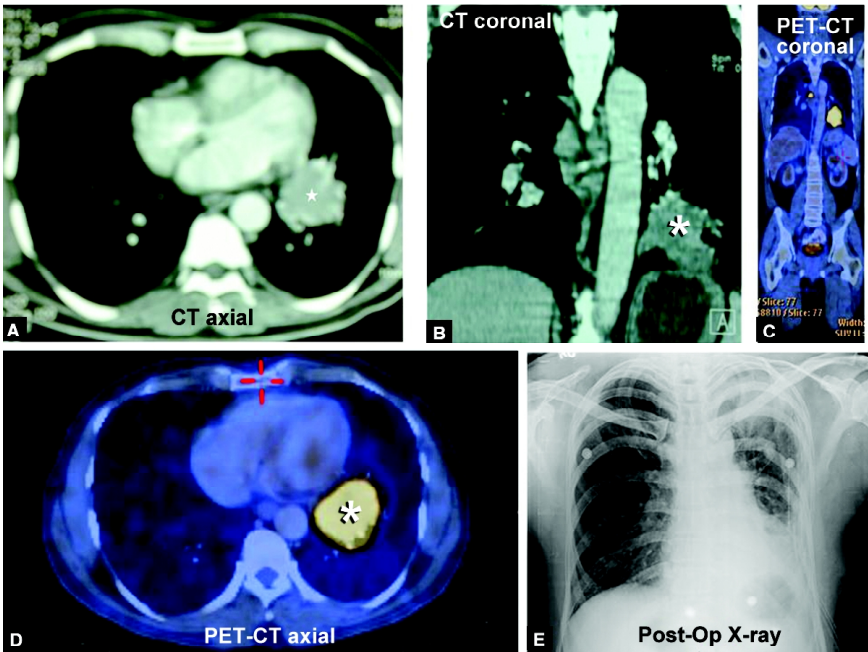
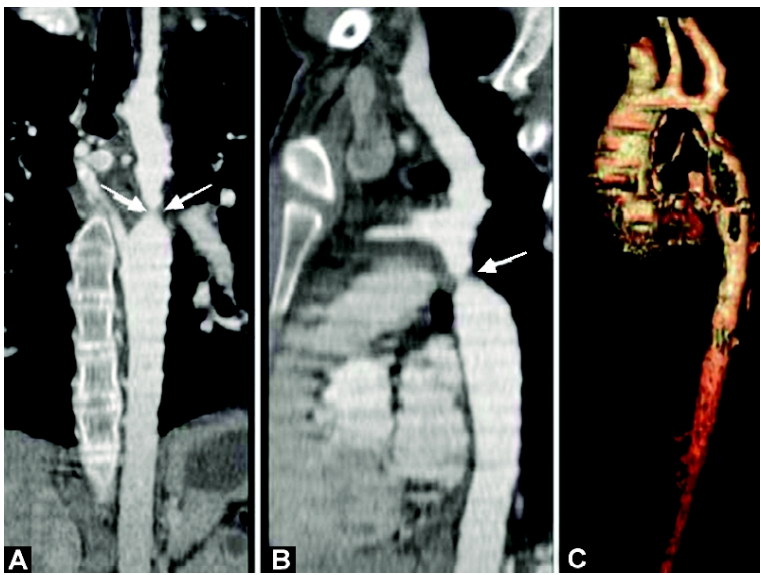


Fig. 11.21: Congestive cardiac failure with pseudotumor

PLATE 1



Figs 5.69A to E



Figs 8.12A to C

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